# *Appendix A*

## Basin Selection Rationale Memorandum

Ash Creek Associates, Inc.
Environmental and Geotechnical Consultants

# Memorandum

**Date:** February 26, 2007

**To:** Krista Koehl, Port of Portland
Nicole Anderson, Port of Portland

**From:** Amanda Spencer, Ash Creek Associates

**cc:** Andy Koulermos, Newfields

**Re:** Rationale for Basin Selection for Storm Water Sampling and
Additional Information Requested by Oregon Department of Environmental Quality (DEQ)
Portland, Oregon
ACA No. 1267

---

This memorandum provides the rationale for selecting basins for storm water solids and whole water sampling and basins for data extrapolation to support the recontamination analysis at Terminal 4 and complete the storm water source evaluation for Terminal 4 Slips1 and 3 Upland Facilities (Upland Facilities; Figure 1). Additional information on surface soil data and the storm water conveyance system requested by the DEQ in a meeting with the Port of Portland on January 9, 2007 has also been included and is described below, following the discussion of the rationale for storm water sampling locations.

## Rationale for Basins Proposed for Sampling

The rationale for basin selection consisted of an evaluation of data needs for completion of the recontamination analysis, as well as data needs to complete the storm water evaluation for Slips 1 and 3. Protocols selected for collecting the storm water data consist of conducting both sediment trap sampling for solids analysis and automatic composite storm water samplers for whole water analysis, where access allows. The following provides the rationale for each of these data needs for each basin proposed for sampling. Figures 2 through 8 provide supporting information (Figure 2 summarizes detected constituents in surface soil; and Figures 3 through 8 list the detected constituent concentrations for metals, total polycyclic aromatic hydrocarbons [PAHs], polychlorinated biphenyls [PCBs], pesticides, semivolatile organic compounds [SVOCs; except PAHs], and total petroleum hydrocarbons [TPH], respectively). Tables 1A through 1C list the PAH concentrations detected in surface soil at the Upland Facilities.

**Basin D** – Basin D was sampled using a sediment trap during the initial deployment. Sufficient sample was recovered to complete analyses for PCBs and pesticides. Basin D is one of the larger basins at Terminal 4 Slips 1 and 3 (17 acres, or 15 percent of the total drained area) and it currently has a unique usage for the Slip 1 and Slip 3

9615 Southwest Allen Boulevard, Suite 106
Portland, Oregon 97005-4814
(503) 924-4704 Portland
(360) 567-3977 Vancouver
(503) 924-4707 Fax
www.ashcreekassociates.com

Upland areas, being used primarily for automobile storage on a paved parking area. Historically, the area was used primarily for petroleum-related activities (e.g., the subsurface Union Pacific Railroad [UPRR] petroleum pipelines and Quaker State above-ground tanks for motor oil storage).

- Storm Water Evaluation Data Needs: Review of historical activities indicates the possibility of TPH or PAHs in surface soil (Hart Crowser, 2000). Remedial Investigation (RI) data did not indicate the presence of TPH in surface soils (releases appear to have been subsurface), but low concentrations of PAHs were detected (see Figures 2 and 3 and Table 1, attached). Phthalates have been identified by the DEQ as a potential storm water contaminant that could be present at all sites due to its ubiquitous nature. Therefore, to address storm water source evaluation data needs, additional storm water sampling and analysis for PAHs, TPH, and phthalates is proposed.
- Recontamination Analysis Data Needs: Sediment samples collected in 2006 demonstrated elevated levels of PAHs and low levels of lead and zinc downstream of Berth 414, which is currently being evaluated for an in-water cap. Therefore, to address potential recontamination analyses data needs, additional storm water data on metals and PAHs are proposed.

Basin D was selected for additional sampling because of its large size (relative to other basins at Slips 1 and 3), unique historical and current usages (relative to other basins in Slips 1 and 3), and the presence of chemicals of potential concern (COPCs) in sediments downstream of its outfall location. The manhole identified for deployment of the sediment trap sampler and installation of the composite storm water sampler is located downgradient of a Downstream Defender installed as a part of system upgrades during the development of this area for additional new Toyota automobile storage in 2004. The manhole was inspected on November 28, 2006, and sufficient access and space is available for the installation of both the sediment traps and a composite storm water sampler.

Basin L – This basin was sampled during the initial deployment for the recontamination analysis and sufficient solids were obtained for analysis for metals, PAHs, PCBs, pesticides, and total organic carbon (TOC). The conveyance system in this basin was recently reconfigured as a part of the railway expansion project at Terminal 4 Slip 1, reducing the drainage basin to 17.2 acres (from an original 30 acres). Basin L is still one of the larger drainage basins at Terminal 4 Slips 1 and 3, comprising 16 percent of the total drained area. Basin L is a sensitive basin for recontamination because it discharges into Wheeler Bay, an area that will be capped during the Terminal 4 Early Action.

- Storm Water Evaluation: Historical activities in basin L included warehousing, and the rail and ship import and export of materials, including soda ash and pencil pitch (Hart Crowser, 2005). Results of a site reconnaissance indicated the potential presence of pencil pitch fragments along the rail tracks. Results of surface soil sampling conducted in potential source areas (including along the rail lines) indicated the presence of detectable concentrations of PAHs, PCBs, metals, and pesticides (Figure 2).
- Recontamination Analysis: Basin L discharges to Wheeler Bay where sediment samples contained elevated concentrations of PAHs and lower levels of lead, zinc, dichloro-diphenyl-trichloroethane (DDT) and PCBs.

Basin L was selected for additional sampling due to its significant percentage of the overall drained area at Slips 1 and 3; the fact that it drains to Wheeler Bay, an area being capped during the Early Action; and the detected compounds in sediments in Wheeler Bay and in surface soil. Both the storm water and recontamination data needs

include sampling and analysis for PAHs, PCBs, metals (including lead and zinc), and pesticides (primarily DDT compounds). Based on site reconnaissance conducted on October 18, 2006, adequate access is available for both in-line sediment trap sampling and an automatic composite sampler, and both are proposed for this basin.

Basin M – This basin was not initially selected for sampling during the 2004/2005 deployment because a large portion of the basin is unpaved and the surface water infiltrates. However, the conveyance system in this basin was reconfigured as a part of the recent railway expansion, and a treatment unit was installed at the downstream end. This reconfiguring included enlarging the drainage area by acquisition of a portion of the adjacent basin L, increasing the basin size to 29.1 acres. Basin M is now the largest basin at Terminal 4 Slips 1 and 3, comprising 26 percent of the drained area. The drainage from this basin currently discharges to Slip 1, but will be reconfigured as part of the Early Action confined disposal facility (CDF). Therefore, an understanding of the storm water load in this conveyance system is needed.

- Storm Water Evaluation: Historical activities in basin M included vehicle parking, equipment storage, and rail import and export of materials, including soda ash and pencil pitch (HartCrowser, 2004). Results of a site reconnaissance indicated the potential presence of pencil pitch fragments along the rail tracks. Results of surface soil sampling conducted in potential source areas (including along the rail lines) indicated the presence of detectable concentrations of PAHs, PCBs, metals (arsenic, cadmium, copper, nickel, lead, mercury, and zinc), and pesticides (Figure 2).
- Recontamination Analysis: Basin M discharges to Slip 1, where sediment samples contained elevated concentrations of PAHs and metals (primarily cadmium, copper, nickel, lead, and zinc), and detections of PCBs and DDT compounds. A treatment system has been installed in the conveyance line for the reconfigured basin M that treats the storm water flow for soluble metals and oil and grease.

Basin M was selected for additional sampling due to its significant percentage of the overall drained area at Slips 1 and 3; its recent reconfiguration to drain a larger area of Slip 1; and its sensitivity for the Early Action recontamination analysis due to the future plan to drain this basin to the river just upstream of the CDF and an area designated by the Early Action for monitored natural recovery (MNR). Both the storm water and recontamination data needs include sampling and analysis for PAHs, PCBs, metals (including lead and zinc), and pesticides (primarily DDT compounds). Based on the October 18, 2006 site reconnaissance, a manhole is present directly downgradient of the treatment unit. Adequate access is available within the manhole for both in-line sediment trap sampling and an automatic composite sampler, and both are proposed for this basin.

Basin Q – This basin was sampled using an in-line sediment trap during the previous storm water sampling deployment. In addition, a grab bulk storm water sample was collected for total suspended solids (TSS) analysis. However, the manhole accessed for the sediment trap installation is upstream of more than 50 percent of the catch basins on this conveyance line. Basin Q is approximately 18 acres, comprising 16 percent of the drained area of Terminal 4 Slips 1 and 3. The outfall for this basin currently is located at the head of Slip 1; however, the conveyance line will be reconfigured to discharge to the river as part of construction of the Early Action CDF.

- Storm Water Evaluation: Historical activities in basin Q consisted of grain storage and associated rail and ground support activities (HartCrowser, 2004). A number of potential source areas were identified and sampled during the RI process. Results of surface soil sampling conducted in potential source areas indicated the presence of detectable concentrations of PAHs, PCBs, pesticides, and metals (chromium, lead, mercury, and zinc; Figure 2).

- Recontamination Analysis: Basin Q discharges to Slip 1 where sediment samples contained elevated concentrations of PAHs and metals (primarily cadmium, copper, nickel, lead, and zinc), and detections of PCBs and DDT compounds.

Basin Q was selected for additional storm water sampling due to its relative size (16 percent of the total drained area of Slips 1 and 3); its unique usage (grain storage with associated support activities); the similarity between detected compounds in surface soil and sediments; and the sensitivity of recontamination because the reconfigured system will drain to Berth 401, an area designated for monitored natural recovery and a small in-water cap as part of the Early Action.

This basin was inspected during the October 18, 2006 reconnaissance to determine if a manhole was present further down the line from the original sediment trap sampling location; and it was confirmed that there is not a manhole further down the conveyance line. However, it is possible to drill down to the line for the installation of a composite storm water sampler and this can be completed in a location downstream of most of the catch basins on the line. Therefore, storm water sampling will be conducted at basin Q via an automatic composite sampler. Further sediment trap sampling is not proposed at this basin because: (1) the sediment trap sampler deployed during the initial deployment period captured sufficient volume to allow for the analysis of the complete set of contaminants of interest (COIs) for this basin (PAHs, metals, PCBs, phthalates, pesticides); (2) if the outfall is submerged (as is the case for this basin), a manhole is needed for the deployment of a sediment trap sampler and a manhole further downstream of the initial sample location is not present; and (3) the collection and analysis of the composite storm water samples will allow sufficient data to assess the contribution from the parts of the system not sampled by the sediment trap to complete the evaluation of mass loading and assess storm water as a potential upland source to the river.

Basin R – Basin R was not sampled during the initial deployment. The basin is approximately 15 acres, comprising 14 percent of the drained area of Slips 1 and 3. This basin discharges upstream of the Berth 401 monitored natural recovery and in-water cap area discussed above.

- Storm Water Evaluation: Historical activities in basin R consisted of ancillary activities to support grain import, export, and storage (HartCrowser, 2004). A number of potential source areas were identified and sampled during the RI process. Results of surface soil sampling conducted in potential source areas indicated the presence of elevated PAHs near the rail lines (which is also near the catch basins for the conveyance line) and detectable concentrations of PAHs, PCBs, pesticides, and metals in other areas of the basin (Figure 2).
- Recontamination Analysis: Basin R discharges upstream of Berth 401 where sediment samples contained PAHs and metals (primarily copper, nickel, and zinc), PCBs, and DDT compounds. An elevated PCB level was also detected in sediment adjacent to this basin.

Basin R was selected for sampling primarily due to the elevated PAHs in surface soil near the conveyance line and additionally because the basin discharges directly upstream of Berth 401 where the Early Action calls for a small sediment cap and monitored natural recovery. The conveyance line was inspected on October 18, 2006, and it was determined that adequate access for both in-line sediment trap sampling and an automatic composite sampler is available. Both sampling methods will be conducted.

Basin T (City of Portland Outfall 52C) – This outfall drains to Slip 1 and additional data is needed to support the recontamination analysis. The farthest downstream manhole was inspected on October 18, 2006, and it was

determined that there is adequate access for both an in-line sediment trap sampler and an automatic composite sampler. Both are proposed for this basin to provide a comparison of data with the initial deployment and to assess the additional information provided by the bulk stormwater sampling. An access agreement between the Port and the City has been completed to allow this work to proceed.

City of Portland Outfall 53 – Data is needed from this conveyance line to complete the recontamination analysis as it discharges directly upstream of the Early Action area. An in-water sediment trap sampler was placed near this outfall in the 2004/2005 deployment period. However, the sampler deployed near this outfall was tipped over and no sample was obtained. Therefore, sediment trap and automatic composite storm water samplers will be deployed within the conveyance line to evaluate its contribution to the system. An access agreement between the Port and the City has been completed to allow this work to proceed.

## Basins Proposed for Data Extrapolation

As a part of the scoping of the storm water sampling program to meet the source evaluation and recontamination needs, data available for all of the basins were reviewed. Some of the basins were selected (as described above) and some of the basins were determined not appropriate or not necessary for sampling to complete the objectives of the storm water source control evaluation and recontamination analysis. The rationale for the basins selected for data extrapolation is provided below.

Basin C – Sampling of basin C was evaluated to determine data needs for completing the recontamination analysis.

- Recontamination Analysis: Basin C was sampled for solids as part of the 2004/2005 deployment, and the collected solid samples were analyzed for PAHs, metals, phthalates, PCBs, and pesticides (Blasland, Bouck & Lee [BBL], 2005c). Bulk storm water sampling for TSS data was not completed during the 2004/2005 sampling program. As detailed above, storm water and solids from basin D are being sampled. Because the land use and storm water management systems of basins C and D are almost identical, the additional information obtained from basin D during the 2006/2007 deployment can be readily extrapolated to basin C to complete the recontamination analysis of potential upstream contributions from basin C to the Early Action area.

Basin J – Basin J is approximately 2.6 acres, comprising just 2 percent of the total drained area of Slips 1 and 3. The basin outfall drains to the head of Slip 3. Basin J consists of the Gearlocker building and a surrounding unpaved, graveled yard area. With the exception of one catch basin, the drainage to this basin is primarily from roof drains of the Gearlocker building and most of the surface water in this basin infiltrates.

- Storm Water Evaluation and Recontamination Analysis: Historically, land use in basin J consisted of the Quaker State facility. Results of the Terminal 4 Slip 3 RI found a limited area of PAH concentrations (primarily benzo-a-pyrene) that exceeded risk-based human health screening levels for occupational use. The PAHs appear to be limited to the former Quaker State Tank Farm area and the source of the PAHs appears to be associated with the former activities in the Quaker State area (Ash Creek, 2004). Given the presence of pencil pitch observed along the tracks in basins M and L, there is a higher likelihood of PAHs in storm water from these areas than in basin J. Furthermore, site reconnaissance indicates that the area containing the one catch basin not related to the roof drains does not drain the former Quaker State Tank

Farm area. Finally, the area drained by the one catch basin is extremely limited and represents only a small fraction of the overall area drained at Slips 1 and 3.

Basin J was not selected for sampling due to its small size, limited drained area, and the construction of the basin such that surface water predominantly infiltrates into the subsurface through the basin's graveled surface. PAHs are the only constituent of potential concern in basin J, and the PAH results from basin L can conservatively be extrapolated to basin J for the source control and mass loading evaluations.

Basin K – Basin K is approximately 1.5 acres, comprising just 1 percent of the total drained area of Slips 1 and 3. The basin consists of two catch basins and an outfall draining to the head of Slip 3. Based on land use, the basin can be considered a sub-area of basin L, being comprised of identical usage (part trackage and part Kinder Morgan operational facility).

- Storm Water Evaluation and Recontamination Analysis: As identified above, historical and current land use in basin K is identical to basin L. Given the same usage, the surface soil is expected to contain the same COPCs as identified in basin L (PAHs, PCBs, pesticides, and metals), and at the same levels.

Basin K was not selected for sampling due to its small size, limited drained area, and identical current and historical land use with basin L. Results from basin L can be extrapolated to basin K for both the source control and mass loading evaluations.

Basin N – Basin N is approximately 3.5 acres, comprising just 3 percent of the total drained area of Slips 1 and 3. The basin currently drains to the head of Slip 1 but will be reconfigured to discharge to the river as part of construction of the CDF. Basin N was originally selected for sampling for the 2005 deployment (BBL, 2005b); however, a field reconnaissance by BBL on January 12, 2005, determined that land use was similar to larger basins that drain to the same sub-area, and the basin was not sampled during the 2005 deployment.

- Storm Water Evaluation: This basin drains a graveled area to the west of the Rogers Terminal and Shipping facility. International Raw Materials (IRM) is south of basin N and little runoff from IRM appears able to drain to this basin. Only a small portion of a graveled roadway used by IRM appears to have the potential to drain to one catch basin of basin N. The IRM facility is primarily unpaved and surface water at IRM appears to infiltrate. Potential source areas in basin N were identified and sampled as a part of the RI. Results of surface soil analysis indicated detections of PAHs and metals. Elevated concentrations of lead were detected in one localized area during the RI and this basin was reconsidered for sampling based on the lead results. However, site reconnaissance on October 18, 2006, demonstrated that storm water from the surface soil area containing lead would not flow to the basin N catch basin/conveyance system. The detected concentrations of PAHs and metals outside of the localized lead area are similar to or lower than those found in other basins being sampled (e.g., basins R, Q, M, and L; see Figures 3 and 4 and Table 1, attached). Current use of basin N is limited primarily to surface vehicle traffic and rail spurs, similar to current uses in basins O, L, and R.
- Recontamination Analysis: As identified above, the current use of basin N is limited to primarily surface vehicle traffic and rail spurs, similar to current uses in basins O, L, and R.

Due to the small basin size and similar uses to other basins, sampling at this basin is not proposed. Data collected at basins L and R in the upcoming deployment, and from O during the initial deployment, can be used to evaluate the

potential adverse effects of storm water sources in basin N. This will provide a conservative assessment of storm water source and recontamination potential, because the land use within basin N, while similar, is more limited than the above basins. Additionally, the COPC concentrations in surface soil in potential source areas identified during the RI are similar to or lower than concentrations in the other basins (see Figures 3 through 7, attached).

Basin O – Basin O is approximately 5.5 acres, comprising just 5 percent of the drained area of Slips 1 and 3. This basin was sampled during the initial deployment and the samples were analyzed for the presence of metals due to the presence of a temporary soil stockpile in the area.

- Storm Water Evaluation: Historical land uses in basin O were limited, and only two potential source areas were identified during the RI proposal process that required further assessment. These uses (ancillary areas to the grain storage silos and the possible presence of a disposal area of creosoted wood) were the same as identified in basin Q. Surface soil sample results indicated the presence of low concentrations of metals, PAHs, and pesticides in the waste-wood area, and low concentrations of PCBs in the grain storage area. These detections were similar in magnitude and composition to surface soil sampling results from similar source areas identified in basin Q (see Figures 3 through 7). No other source areas that could have impacted surface soil were identified in the DEQ-approved RI Work Plan.
- Recontamination Analysis: Plans to remove the temporary stockpile are underway at the Port. Uses of basin O are limited to some vehicular traffic for trucks or cars traveling to and from basins L and M and the UPRR railroad tracks on the north side of the basin.

This basin was not selected for additional sampling due to its small size, limited current and historical land use, lack of surface sources, and similarity in surface soil sampling results to basin Q. Results from basin Q can be extrapolated to basin O to assess for potential storm water source issues and recontamination analysis.

Basin S – Basin S is approximately 1 acre and comprises less than 1 percent of the drained area of Slips 1 and 3. This basin was not selected for sampling in the 2005 deployment due to its small size.

- Storm Water and Recontamination Analysis Evaluation: Historical land use in basins R, S, and Q comprised the former grain import, export, and storage operation at Slip 1. The area is primarily vacant at this time. No potential surface soil sources were identified in the basin S area in the DEQ-approved RI work plan for Terminal 4 Slip 1 Upland Facility, and no surface soil sampling was conducted in this area. The basin is predominantly paved.

Due to its small size, lack of surface sources, and similar land use to basins Q and R, basin S was not selected for sampling. Storm water sampling results from basins Q and R can be extrapolated to basin S to conservatively assess potential source control and recontamination analysis elements.

Finally, to assist in both the recontamination evaluation and the storm water characterization program, Ash Creek plans to walk the Terminal 4 Upland Facility during a significant rain event (e.g., an event with more than 1/2 inch of rain in a 24-hour period, if possible,) to physically observe and document areas of overland flow and infiltration. Specifically, areas adjacent to river and slip banks will be evaluated to assess the potential for overland flow to the banks from the facility. Similarly, catch basins within each drainage basin will be observed to better estimate the aerial extent of drained area and document areas of infiltration.

## Additionally Requested Information

The DEQ has requested information to assist in its evaluation of storm water in accordance with the Joint Source Control Strategy (JSCS) guidance document (DEQ, 2006). Specifically, the DEQ requested:

1. A site plan showing paved and unpaved areas in relation to the storm water conveyance system (including catch basins) and surface soil sampling locations. Figure 9, attached, shows each of these elements.

2. Screening of analytical results for surface soil samples collected within 100 feet of existing catch basins against DEQ JSCS toxicity and bioaccumulative sediment screening levels. Figure 10 provides a summary of this information and identifies surface soil sampling locations within 100 feet that have concentrations of COI that exceed either the JSCS toxicity or bioaccumulative screening level values for sediment. Figure 11 shows the locations of surface soil samples where detected COI concentrations exceed JSCS sediment screening levels, regardless of location relative to a catch basin.

In addition, Figures 3 through 8 summarize COI detected in surface soil samples collected during the RI programs for the Upland Facilities: Figure 3 presents metals concentrations detected in surface soil above regional background concentrations[1]; Figure 4 presents the total PAH concentrations detected in surface soil samples; and Figures 5 through 8 summarize the detected concentrations of PCBs, pesticides, semi-volatile organic compounds (other than PAHs), and TPH, respectively. On each of the figures, a table is included that lists the JSCS sediment screening levels for the detected constituents for comparison. Finally, Tables 1A through 1C provide the detected PAH concentrations in surface soils from the Upland Facilities and include a screen against PECs as represented on Table 3-1 of JSCS sediment screening levels (bioaccumulative sediment screening level values are not provided on the JSCS document ,Table 3-1 for PAHs).

## ATTACHMENTS:

Table 1A – PAHs in Surface Soil
Table 1B – PAHs and TPH in Surface Soil Samples
Table 1C – PAH Concentrations in Surface Soil
Figure 1 – Facility Location Map
Figure 2 – Constituents Detected in Surface Soil
Figure 3 – Metals Concentrations Detected Above Regional Background in Surface Soil
Figure 4 – Total Polynuclear Aromatic Hydrocarbons Detected in Surface Soil
Figure 5 – Polychlorinated Biphenyl Concentrations Detected in Surface Soil
Figure 6 – Pesticide Concentrations Detected in Surface Soil
Figure 7 – Semi-Volatile Organic Compounds Detected in Surface Soil (Except Polynuclear Aromatic Hydrocarbons)
Figure 8 – Total Petroleum Hydrocarbon Concentrations Detected in Surface Soil
Figure 9 – Location of Surface Soil Sampling Points, Drainage Basins, and Conveyance Lines
Figure 10 – Exceedances of JSCS Sediment Screening Levels in Surface Soil Within 100 feet of Catch Basins
Figure 11 – Surface Soil Results Compared to JSCS Sediment Screening Levels

[1] Rrepresented by the Washington Department of Ecology publication Natural Background Soil Metal Concentrations in Washington State dated October 1994.

Table 1A - PAHs in Surface Soil
Terminal 4 Slip 1 Upland Facility

| | Sample ID | T4S1S-11 | T4S1S-12 | T4S1S-13 | T4S1S-15-0.5 | T4S1S-16-0.5 | T4S1S-17-0.5 | T4S1S-18-0.5 | T4S1S-19-0.5 | T4S1S-5 | T4S1S-6 | T4S1S-7 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | Drainage Basin | R | R | R | R | R | R | R | R | R | R | R |
| | Lab ID | K2502049-008 | K2502049-009 | K2502049-010 | K2502049-010 | K2502049-010 | K2502049-010 | K2502049-010 | K2502049-010 | | | |
| | Sample Interval | 0 - 0.5 | 0 - 0.5 | 0 - 0.5 | 0.5 - 1 | 0.5 - 1 | 0.5 - 1 | 0.5 - 1 | 0.5 - 1 | 0 - 0.5 | 0 - 0.5 | 0 - 0.5 |
| | Sample Date | 3/22/2005 | 3/22/2005 | 3/22/2005 | 9/6/2005 | 9/6/2005 | 9/6/2005 | 9/6/2005 | 9/6/2005 | 3/22/2005 | 3/22/2005 | 3/22/2005 |
| | OU | OU1 | OU1 | OU1 | OU1 | OU1 | OU1 | OU1 | OU1 | OU1 | OU1 | OU1 |
| Compound (Concentrations in µg/kg) | McDonalds PECs | | | | | | | | | | | |
| Naphthalene | 561 | 7.9 | 76 | 28 | 17.5 U, D | 140 U | 71.8 U | 14.2 U | 70.8 U | 330 U, J | 330 U, J | 91 J |
| 2-Methylnaphthalene | 200 | 5.3 | 42 | 16 | -- | -- | -- | -- | -- | 330 U, J | 330 U, J | 65 J |
| Acenaphthylene | 200 | 11 | 29 | 31 | 29 J, D | 140 U | 56.8 J, D | 14.2 U | 37.4 J, D | 330 U, J | 330 U, J | 97 J |
| Acenaphthene | 300 | 14 | 340 | 200 | 37.1 J, D | 53.5 J, D | 37.8 J, D | 7.32 J, D | 17.6 J, D | 340 U, J | 340 U, J | 350 J |
| Fluorene | 536 | 6.4 | 110 | 65 | 22.6 J, D | 140 U | 21.5 J, D | 14.2 U | 70.8 U | 340 U, J | 340 U, J | 180 J |
| Dibenzofuran | -- | 4.4 J | 62 | 36 | -- | -- | -- | -- | -- | 340 U, J | 340 U, J | 100 J |
| Phenanthrene | 1170 | 90 | 2000 D | 1300 D | 258 D | 313 D | 203 D | 37.6 D | 136 D | 47 J | 100 J | 1700 J |
| Anthracene | 845 | 31 | 350 | 220 | 78 D | 66.1 J, D | 115 D | 8.62 J, D | 50.2 J, D | 30 J | 24 J | 390 J |
| Fluoranthene | 2230 | 290 | 6400 D | 3900 D | 667 D | 853 D | 490 D | 88.8 D | 359 D | 26 J | 110 J | 3100 |
| Pyrene | 1520 | 290 | 5800 D | 3800 D | 734 D | 900 D | 552 D | 99.2 D | 456 D | 77 J | 170 J | 2700 |
| Benzo(b)fluoranthene | -- | 310 | 6200 D | 3900 D | 616 D | 1080 D | 631 D | 79.5 D | 342 D | 92 J | 210 J | 3800 |
| Benzo(k)fluoranthene | 13000 | 300 | 4200 D | 3300 D | 627 D | 695 D | 604 D | 85.1 D | 378 D | 31 J | 85 J | 1100 J |
| Benzo(a)anthracene | 1050 | 190 | 3900 D | 2400 D | 446 D | 581 D | 358 D | 57.3 D | 249 D | 52 J | 100 J | 2200 |
| Chrysene | 1290 | 250 | 4900 D | 3200 D | 585 D | 789 D | 467 D | 72 D | 335 D | 69 J | 140 J | 2500 |
| Benzo(a)pyrene | 1450 | 310 | 6000 D | 3800 D | 616 D | 830 D | 571 D | 83.8 D | 354 D | 69 J | 150 J | 2800 |
| Indeno(1,2,3-cd)pyrene | 100 | 390 | 5400 D | 3700 D | 344 D | 403 D | 290 D | 41.3 D | 185 D | 64 J | 130 J | 2500 |
| Dibenz(a,h)anthracene | 1300 | 77 | 1100 | 780 | 117 D | 142 D | 99.4 D | 14.5 D | 61.6 J, D | 330 U | 35 J | 660 |
| Benzo(g,h,i)perylene | 300 | 380 | 5000 D | 3400 D | 372 D | 416 D | 294 D | 44.6 D | 206 D | 93 J | 140 J | 2600 |

***Notes:***

1. PAHs = Polynuclear Aromatic Hydrocarbons by EPA Method 8270C (SIM).
2. µg/kg = Micrograms per kilogram.
3. PEC = Probable Effect Concentration, values taken from Portland Harbor Joint Source Control Strategy, Final - Dec. 2005
4. -- = No screening level available or not analyzed.
5. J = The result is an estimated concentration that is less than the method reporting limit (MRL) but greater than or equal to the method detection limit (MDL).
6. U = The compound was analyzed for but was not detected at or above the MRL/MDL.
7. D = Dilution.
8. **Bold** values indicate that the detected concentration exceeds the PEC.
9. Sample ID nomenclature is per the following: type of sample-sample number-depth in feet-designation.
   For example T4S1SB-46-1-1 = soil boring (SB) number 46, collected 1 foot below the ground surface, primary sample (1).
   Soil sample number 6 = T4S1S-6 = surface

Table 1A - PAHs in Surface Soil
Terminal 4 Slip 1 Upland Facility

| | Sample ID | T4S1SB-14-1-1 | T4S1SB-15-1-1 | T4S1SB-16-1-1 | T4S1SB-17-1-1 | T4S1SB-18-1-1 | T4S1SB-31-0-1 | T4S1SB-32-0-1 | T4S1SB-33-0-1 | T4S1SB-42-1-1 | T4S1SB-45-1-1 | T4S1SB-46-1-1 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | Drainage Basin | R | R | R | R | R | Q | Q | Q | R | R | R |
| | Lab ID | K2406368-002 | K2406804-009 | K2406804-007 | K2406848-001 | K2406699-005 | K2406848-007 | K2406767-009 | K2406804-001 | K2406804-003 | K2406321-001 | K2406321-002 |
| | Sample Interval | 1 - 2 | 1 - 2 | 0.5 - 1.5 | 1 - 2 | 1 - 1.5 | 0.5 - 1.5 | 0.5 - 1.5 | 0.25 - 1 | 0.5 - 1.5 | 0.5 - 2 | 0.5 - 2 |
| | Sample Date | 8/24/2004 | 9/3/2004 | 9/3/2004 | 9/7/2004 | 9/2/2004 | 9/3/2004 | 9/3/2004 | 9/3/2004 | 9/3/2004 | 8/23/2004 | 8/23/2004 |
| | OU | OU1 | OU1 | OU1 | OU1 | OU1 | OU1 | OU1 | OU1 | OU1 | OU1 | OU1 |
| Compound (Concentrations in µg/kg) | McDonalds PECs | | | | | | | | | | | |
| Naphthalene | 561 | 10 | 2.8 J | 2.4 J | 2.1 J | 20 | 33 | 1.3 J | 9.9 | 2.6 J | 36 | 1.2 J |
| 2-Methylnaphthalene | 200 | 6.8 | 1.4 J | 1.5 J | 1.4 J | 18 | 50 | 0.66 J | 15 | 1.4 J | 37 | 0.76 J |
| Acenaphthylene | 200 | 50 | 3.5 J | 3.2 J | 3.8 J | 13 | 14 | 5 U | 7.7 | 13 | 27 | 0.59 J |
| Acenaphthene | 300 | 11 | 0.56 J | 0.72 J | 1.1 J | 1.9 J | 1.7 J | 5 U | 0.78 J | 1.2 J | 1.8 J | 4.9 U |
| Fluorene | 536 | 8.2 | 0.51 J | 0.63 J | 1.5 J | 1.8 J | 2.7 J | 5 U | 1.4 J | 0.66 J | 4.2 J | 4.9 U |
| Dibenzofuran | -- | 7.5 | 0.54 J | 0.75 J | 0.37 J | 5.5 | 21 | 5 U | 4 J | 0.94 J | 9.8 | 4.9 U |
| Phenanthrene | 1170 | 260 | 7.9 | 7.3 | 30 | 51 | 66 | 0.66 J | 46 | 17 | 110 | 1.2 J |
| Anthracene | 845 | 68 | 4.4 J | 5 | 9.3 | 19 | 20 | 5 U | 9.4 | 12 | 32 | 0.78 J |
| Fluoranthene | 2230 | 520 | 18 | 15 | 39 | 120 | 73 | 1.3 J | 48 | 62 | 280 | 3.4 J |
| Pyrene | 1520 | 560 | 25 | 20 | 60 | 130 | 110 | 1.5 J | 72 | 82 | 360 | 4.8 J |
| Benzo(b)fluoranthene | -- | 320 | 15 | 16 | 14 | 78 | 140 | 1 J | 61 | 58 | 230 | 2.1 J |
| Benzo(k)fluoranthene | 13000 | 260 | 13 | 12 | 15 | 91 | 67 | 0.66 J | 49 | 45 | 170 | 1.7 J |
| Benzo(a)anthracene | 1050 | 210 | 11 | 9 | 24 | 59 | 66 | 0.98 J | 38 | 58 | 150 | 2.1 J |
| Chrysene | 1290 | 340 | 17 | 15 | 27 | 96 | 150 | 0.91 J | 63 | 69 | 230 | 2.2 J |
| Benzo(a)pyrene | 1450 | 320 | 8.9 | 12 | 15 | 84 | 97 | 0.65 J | 58 | 53 | 250 | 1.8 J |
| Indeno(1,2,3-cd)pyrene | 100 | 330 | 15 | 15 | 12 | 82 | 84 | 0.92 J | 61 | 39 | 280 | 3 J |
| Dibenz(a,h)anthracene | 1300 | 53 | 2.6 J | 2.7 J | 2.6 J | 12 | 24 | 5 U | 13 | 9.6 | 39 | 0.54 J |
| Benzo(g,h,i)perylene | 300 | 320 | 17 | 16 | 12 | 100 | 110 | 0.87 J | 67 | 40 | 290 | 3.1 J |

***Notes:***

1. PAHs = Polynuclear Aromatic Hydrocarbons by EPA Method 8270C (SIM).
2. µg/kg = Micrograms per kilogram.
3. PEC = Probable Effect Concentration, values taken from Portland Harbor Joint Source Control Strategy, Final - Dec. 2005
4. -- = No screening level available or not analyzed.
5. J = The result is an estimated concentration that is less than the method reporting limit (MRL) but greater than or equal to the method detection limit (MDL).
6. U = The compound was analyzed for but was not detected at or above the MRL/MDL.
7. D = Dilution.
8. **Bold** values indicate that the detected concentration exceeds the PEC.
9. Sample ID nomenclature is per the following: type of sample-sample number-depth in feet-designation.
   For example T4S1SB-46-1-1 = soil boring (SB) number 46, collected 1 foot below the ground surface, primary sample (1).
   Soil sample number 6 = T4S1S-6 = surface

Table 1A - PAHs in Surface Soil
Terminal 4 Slip 1 Upland Facility

| | Sample ID | T4S1SB-47-1-1 | T4S1SB-48-1-1 | T4S1SB-49-1-1 | T4S1SB-50-1-1 | T4S1SB-82-1-1 | T4S1SB-83-1-1 | T4S1SB-89-0-1 | T4S1SB-90-0-2 | T4S1SB-9-0-1 | T4S1SB-92-0-1 | T4S1SB-93-0-1 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | Drainage Basin | R | R | R | R | R | R | Q | Q | R | O | O |
| | Lab ID | K2406321-004 | K2406321-005 | K2406321-006 | K2406368-001 | K2406644-003 | K2406644-001 | | | K2406699-003 | | |
| | Sample Interval | 0.5 - 2 | 0.5 - 2 | 0.5 - 2 | 0.5 - 2.5 | 0.5 - 1.5 | 1 - 2 | 0.5 - 2.5 | 1 - 3 | 0 - 1 | 1 - 3 | 0.5 - 2.5 |
| | Sample Date | 8/23/2004 | 8/23/2004 | 8/23/2004 | 8/23/2004 | 9/1/2004 | 9/1/2004 | 9/7/2005 | 9/7/2005 | 9/2/2004 | 9/7/2005 | 9/7/2005 |
| | OU | OU1 | OU1 | OU1 | OU1 | OU1 | OU1 | OU1 | OU1 | OU1 | OU1 | OU1 |
| Compound (Concentrations in µg/kg) | McDonalds PECs | | | | | | | | | | | |
| Naphthalene | 561 | 1.4 J | 1.4 J | 1.4 J | 1.1 J | 2.7 J | 1.9 J | 15.2 U | 14.3 U | 3.1 J | 3.49 J, D | 7.47 U, D |
| 2-Methylnaphthalene | 200 | 0.91 J | 0.92 J | 0.84 J | 0.64 J | 1.6 J | 0.78 J | -- | -- | 1.5 J | -- | -- |
| Acenaphthylene | 200 | 0.27 J | 0.52 J | 5 U | 0.46 J | 2.3 J | 0.47 J | 15.2 U | 14.3 U | 1.7 J | 5.88 J, D | 7.47 U, D |
| Acenaphthene | 300 | 4.9 U | 4.9 U | 5 U | 5 U | 2.2 J | 4.9 U | 15.2 U | 14.3 U | 0.33 J | 20.2 D | 7.47 U, D |
| Fluorene | 536 | 4.9 U | 4.9 U | 5 U | 5 U | 1.4 J | 0.36 J | 15.2 U | 14.3 U | 0.57 J | 8.27 J, D | 7.47 U, D |
| Dibenzofuran | -- | 4.9 U | | | 5 U | 0.74 J | 0.23 J | -- | -- | 0.49 J | -- | -- |
| Phenanthrene | 1170 | 0.79 J | 1.3 J | 0.87 J | 0.56 J | 12 | 1.3 J | 7.65 J | 14.3 U | 4.8 | 105 D | 15.8 J, D |
| Anthracene | 845 | 0.32 J | 0.51 J | 5 U | 0.65 J | 4.8 J | 0.81 J | 15.2 U | 14.3 U | 2.6 J | 26.3 D | 7.47 U, D |
| Fluoranthene | 2230 | 1.9 J | 2.2 J | 1.7 J | 1.5 J | 35 | 2.7 J | 15.3 D | 14.3 U | 11 | 263 D | 41.9 D |
| Pyrene | 1520 | 2.5 J | 2.6 J | 1.7 J | 1.7 J | 34 | 3.8 J | 24.7 D | 5.56 J, D | 14 | 309 D | 40.5 D |
| Benzo(b)fluoranthene | -- | 1.4 J | 1.4 J | 1.4 J | 1.8 J | 24 | 1.5 J | 18.9 D | 14.3 U | 7 | 326 D | 59.5 J |
| Benzo(k)fluoranthene | 13000 | 1.1 J | 0.85 J | 0.9 J | 1.1 J | 31 | 2.7 J | 13.9 J, D | 14.4 U | 12 | 248 D | 33.6 J |
| Benzo(a)anthracene | 1050 | 1.6 J | 0.89 J | 1.4 J | 1.3 J | 15 | 1.5 J | 10.1 J, D | 14.4 U | 5.5 | 201 D | 31.2 D |
| Chrysene | 1290 | 1.5 J | 1.4 J | 1.2 J | 1.3 J | 28 | 2.7 J | 21.4 D | 14.3 U | 11 | 238 D | 43.3 D |
| Benzo(a)pyrene | 1450 | 1.4 J | 1.2 J | 1.1 J | 1.2 J | 21 | 2.6 J | 16.9 D | 4.86 J, D | 6.1 | 281 D | 47.8 J |
| Indeno(1,2,3-cd)pyrene | 100 | 1.7 J | 1.9 J | 1.4 J | 2 J | 28 | 2.8 J | 8.8 J, D | 14.4 U | 9.5 | 121 D | 25.3 J |
| Dibenz(a,h)anthracene | 1300 | 0.37 J | 0.3 J | 5 U | 5 U | 5.9 | 4.9 U | 15.2 U | 14.4 U | 2 J | 43.9 D | 12 J |
| Benzo(g,h,i)perylene | 300 | 1.8 J | 2.3 J | 1.4 J | 2.3 J | 26 | 3.5 J | 11 J, D | 14.3 U | 9.7 | 133 D | 28.1 J |

***Notes:***

1. PAHs = Polynuclear Aromatic Hydrocarbons by EPA Method 8270C (SIM).
2. µg/kg = Micrograms per kilogram.
3. PEC = Probable Effect Concentration, values taken from Portland Harbor Joint Source Control Strategy, Final - Dec. 2005
4. -- = No screening level available or not analyzed.
5. J = The result is an estimated concentration that is less than the method reporting limit (MRL) but greater than or equal to the method detection limit (MDL).
6. U = The compound was analyzed for but was not detected at or above the MRL/MDL.
7. D = Dilution.
8. **Bold** values indicate that the detected concentration exceeds the PEC.
9. Sample ID nomenclature is per the following: type of sample-sample number-depth in feet-designation.
   For example T4S1SB-46-1-1 = soil boring (SB) number 46, collected 1 foot below the ground surface, primary sample (1).
   Soil sample number 6 = T4S1S-6 = surface

Table 1A - PAHs in Surface Soil
Terminal 4 Slip 1 Upland Facility

| | Sample ID | T4S1SB-94-0-1 | T4S1SB-94-0-2 | T4S1SB-95-0-1 | AOC72-S1-0.5 | AOC72-S1-1.5 | AOC72-S2-0.5 | AOC72-S2-1.5 | AOC72-S3-0.5 | AOC72-S3-1.5 | MW16-0.5-1 | T4S1S-10-1 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | Drainage Basin | Q | Q | Q | L | L | L | L | L | L | L | K |
| | Lab ID | | K2502049-010 | | | | | | | | K2402343-006 | K2406499-005 |
| | Sample Interval | 1 - 3 | 1 - 3 | 0.5 - 2.5 | 0.5 - 1.5 | 1.5 - 2.5 | 0.5 - 1.5 | 1.5 - 2.5 | 0.5 - 1.5 | 1.5 - 2.5 | 0.5 - 1 | 0 - 0.5 |
| | Sample Date | 9/7/2005 | 9/7/2005 | 9/7/2005 | 3/8/2004 | 3/8/2004 | 3/8/2004 | 3/8/2004 | 3/8/2004 | 3/8/2004 | 3/29/2004 | 8/27/2004 |
| | OU | OU1 | OU1 | OU1 | OU2 | OU2 | OU2 | OU2 | OU2 | OU2 | OU2 | OU2 |
| Compound (Concentrations in µg/kg) | McDonalds PECs | | | | | | | | | | | |
| Naphthalene | 561 | 5.75 J, D | 5.49 J, D | 12 J, D | 1.3 J | 4.8 U | 0.24 J | 4.8 U | 4.7 U | 0.34 J | 3.6 J | 19 |
| 2-Methylnaphthalene | 200 | -- | -- | -- | 1.1 J | 4.8 U | 4.7 U | 4.8 U | 4.7 U | 4.8 U | -- | 5.9 |
| Acenaphthylene | 200 | 3.53 U | 14.5 U | 11.2 J, D | 2 J | 4.8 U | 0.36 J | 4.8 U | 4.7 U | 0.25 J | 3.3 J | 10 |
| Acenaphthene | 300 | 3.53 U | 14.5 U | 34.9 D | 0.66 J | 4.8 U | 4.7 U | 4.8 U | 4.7 U | 4.8 U | 0.6 J | 2.1 J |
| Fluorene | 536 | 3.53 U | 14.5 U | 14.3 D | 1.7 J | 4.8 U | 0.2 J | 4.8 U | 4.7 U | 4.8 U | 0.56 J | 1.9 J |
| Dibenzofuran | -- | -- | -- | -- | 0.79 J | 4.8 U | 4.7 U | 4.8 U | 4.7 U | 4.8 U | -- | 1.5 J |
| Phenanthrene | 1170 | 17.4 D | 15.3 D | 212 D | 6.6 | 1.3 J | 1.5 J | 1.1 J | 1.2 J | 0.25 J | 9.5 | 52 |
| Anthracene | 845 | 4.92 J, D | 4.47 J, D | 41.7 D | 2.9 J | 0.63 J | 1.4 J | 0.75 J | 0.62 J | 0.33 J | 3.2 J | 13 |
| Fluoranthene | 2230 | 34.8 D | 26.7 D | 520 D | 7.9 | 1.2 J | 2.7 J | 0.98 J | 1.1 J | 0.44 J | 30 | 270 |
| Pyrene | 1520 | 37.5 D | 37.9 D | 650 D | 11 | 1.2 J | 2.9 J | 0.91 J | 1.1 J | 0.55 J | 41 | 380 |
| Benzo(b)fluoranthene | -- | 40.6 J | 31.2 D | 644 D | 3.7 J | 0.16 J | 2.3 J | 4.8 U | 4.7 U | 0.42 J | 26 | 200 |
| Benzo(k)fluoranthene | 13000 | 24.9 J | 20.3 D | 480 D | 5.3 | 0.19 J | 1.5 J | 0.18 J | 0.22 J | 0.4 J | 25 | 170 |
| Benzo(a)anthracene | 1050 | 19.8 D | 14.5 D | 383 D | 4.2 J | 0.45 J | 1.3 J | U | 0.22 J | 0.21 J | 17 | 180 |
| Chrysene | 1290 | 34.8 D | 26.7 D | 474 D | 6.3 | 0.38 J | 1.9 J | 0.21 J | 0.31 J | 0.41 J | 25 | 250 |
| Benzo(a)pyrene | 1450 | 32.1 J | 24.4 D | 568 D | 4.5 J | 0.26 J | 0.77 J | 0.23 J | 0.23 J | 0.19 J | 37 | 270 |
| Indeno(1,2,3-cd)pyrene | 100 | 25.8 J | 14.2 J, D | 242 D | 3.7 J | 4.8 U | 0.9 J | 4.8 U | 4.7 U | 0.28 J | 51 | 240 |
| Dibenz(a,h)anthracene | 1300 | 7.03 J, D | 4.1 J, D | 84.7 D | 0.44 J | 4.8 U | 4.7 U | 4.8 U | 4.7 U | 4.8 U | 7.4 | 35 |
| Benzo(g,h,i)perylene | 300 | 34.1 J | 18.1 D | 258 D | 4.9 J | 0.15 J | 1.1 J | 0.21 J | 4.7 U | 0.49 J | 64 | 270 |

***Notes:***

1. PAHs = Polynuclear Aromatic Hydrocarbons by EPA Method 8270C (SIM).
2. µg/kg = Micrograms per kilogram.
3. PEC = Probable Effect Concentration, values taken from Portland Harbor Joint Source Control Strategy, Final - Dec. 2005
4. -- = No screening level available or not analyzed.
5. J = The result is an estimated concentration that is less than the method reporting limit (MRL) but greater than or equal to the method detection limit (MDL).
6. U = The compound was analyzed for but was not detected at or above the MRL/MDL.
7. D = Dilution.
8. **Bold** values indicate that the detected concentration exceeds the PEC.
9. Sample ID nomenclature is per the following: type of sample-sample number-depth in feet-designation.
   For example T4S1SB-46-1-1 = soil boring (SB) number 46, collected 1 foot below the ground surface, primary sample (1).
   Soil sample number 6 = T4S1S-6 = surface

Table 1A - PAHs in Surface Soil
Terminal 4 Slip 1 Upland Facility

| | Sample ID | T4S1S-14B | T4S1S-8-1 | T4S1S-9-1 | T4S1SB-53-1-1 | T4S1SB-55-1-1 | T4S1SB-58-1-1 | T4S1SB-70-1-1 | T4S1SB-71-1-1 | T4S1SB-72-1-1 | T4S1SB-73-1-1 | T4S1SB-74-1-1 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | Drainage Basin | M | L | L | L | M | M | L | L | L | L | L |
| | Lab ID | K2502049-011 | K2406499-007 | K2406499-006 | K2406534-003 | K2406589-004 | K2406589-007 | K2406457-008 | K2406457-007 | K2406457-006 | K2406457-004 | K2406457-003 |
| | Sample Interval | 0.5 - 1 | 0 - 0.5 | 0 - 0.5 | 0.5 - 1 | 1 - 2 | 1 - 2 | 1 - 2 | 1 - 2 | 1 - 2 | 0.5 - 1.5 | 1 - 2 |
| | Sample Date | 9/8/2005 | 8/27/2004 | 8/27/2004 | 8/27/2004 | 8/27/2004 | 8/31/2004 | 8/26/2004 | 8/26/2004 | 8/26/2004 | 8/26/2004 | 8/26/2004 |
| | OU | OU2 | OU2 | OU2 | OU2 | OU2 | OU2 | OU2 | OU2 | OU2 | OU2 | OU2 |
| Compound (Concentrations in µg/kg) | McDonalds PECs | | | | | | | | | | | |
| Naphthalene | 561 | 14.1 U | 1.9 J | 6.5 | 3.2 J | 1.9 J | 0.98 J | 330 U | 330 U | 330 U | 330 U | 340 U |
| 2-Methylnaphthalene | 200 | -- | 0.7 J | 2.1 J | 1.5 J | 1 J | 0.5 J | 330 U | 330 U | 330 U | 330 U | 340 U |
| Acenaphthylene | 200 | 14.1 U | 1.3 J | 6 | 1.5 J | 0.47 J | 4.3 U | 330 U | 330 U | 330 U | 330 U | 340 U |
| Acenaphthene | 300 | 27.4 D | 0.21 J | 0.7 J | 0.28 J | 4.4 U | 4.3 U | 330 U | 330 U | 330 U | 330 U | 340 U |
| Fluorene | 536 | 12.5 J, D | 0.31 J | 1.1 J | 0.8 J | 0.3 J | 0.21 J | 330 U | 330 U | 330 U | 330 U | 340 U |
| Dibenzofuran | -- | 347 U | 0.35 J | 0.88 J | 0.54 J | 0.38 J | 0.25 J | 330 U | 330 U | 330 U | 330 U | 340 U |
| Phenanthrene | 1170 | 183 D | 1.9 J | 14 | 5.2 | 3.9 J | 0.74 J | 330 U | 330 U | 330 U | 330 U | 340 U |
| Anthracene | 845 | 30.9 D | 1 J | 5.6 | 2.4 J | 0.59 J | 4.3 U | 330 U | 330 U | 330 U | 330 U | 340 U |
| Fluoranthene | 2230 | 483 D | 7.3 | 38 | 11 | 4.6 | 0.81 J | 39 J | 330 U | 330 U | 22 J | 340 U |
| Pyrene | 1520 | 437 D | 10 | 54 | 15 | 4.7 | 0.93 J | 34 J | 330 U | 330 U | 19 J | 340 U |
| Benzo(b)fluoranthene | -- | 476 D | 7.7 | 40 | 5.7 | 3.1 J | 1.2 J | 30 J | 330 U | 330 U | 330 U | 340 U |
| Benzo(k)fluoranthene | 13000 | 438 D | 6.4 | 37 | 8.8 | 2.2 J | 0.81 J | 330 U | 330 U | 330 U | 330 U | 340 U |
| Benzo(a)anthracene | 1050 | 315 D | 5.8 | 26 | 4.5 J | 2.6 J | 0.41 J | 22 J | 330 U | 330 U | 330 U | 340 U |
| Chrysene | 1290 | 388 D | 7 | 36 | 9.3 | 4.2 J | 1.3 J | 30 J | 330 U | 330 U | 14 J | 340 U |
| Benzo(a)pyrene | 1450 | 455 D | 10 | 55 | 8 | 2.1 J | 0.7 J | 26 J | 330 U | 330 U | 330 U | 340 U |
| Indeno(1,2,3-cd)pyrene | 100 | 209 D | 10 | 63 | 9.2 | 2.3 J | 1.1 J | 330 U | 330 U | 330 U | 330 U | 340 U |
| Dibenz(a,h)anthracene | 1300 | 76.9 D | 1.5 J | 7.9 | 1.5 J | 0.47 J | 0.35 J | 330 U | 330 U | 330 U | 330 U | 340 U |
| Benzo(g,h,i)perylene | 300 | 210 D | 13 | 79 | 11 | 2.6 J | 1.4 J | 34 J | 330 U | 330 U | 330 U | 340 U |

***Notes:***

1. PAHs = Polynuclear Aromatic Hydrocarbons by EPA Method 8270C (SIM).
2. µg/kg = Micrograms per kilogram.
3. PEC = Probable Effect Concentration, values taken from Portland Harbor Joint Source Control Strategy, Final - Dec. 2005
4. -- = No screening level available or not analyzed.
5. J = The result is an estimated concentration that is less than the method reporting limit (MRL) but greater than or equal to the method detection limit (MDL).
6. U = The compound was analyzed for but was not detected at or above the MRL/MDL.
7. D = Dilution.
8. **Bold** values indicate that the detected concentration exceeds the PEC.
9. Sample ID nomenclature is per the following: type of sample-sample number-depth in feet-designation.
   For example T4S1SB-46-1-1 = soil boring (SB) number 46, collected 1 foot below the ground surface, primary sample (1).
   Soil sample number 6 = T4S1S-6 = surface

Table 1A - PAHs in Surface Soil
Terminal 4 Slip 1 Upland Facility

| | Sample ID | T4S1SB-75-1-1 | T4S1SB-76-1-1 | T4S1SB-77-1-1 | T4S1SB-78-1-1 | T4S1SB-79-3-1 | T4S1SB-80-3-1 | T4S1SB-81-3-1 |
|---|---|---|---|---|---|---|---|---|
| | Drainage Basin | L | L | N | N | N | N | N |
| | Lab ID | K2406457-002 | K2406457-001 | K2406532-001 | K2406532-003 | K2406589-001 | K2406532-005 | K2406532-006 |
| | Sample Interval | 1 - 2 | 1 - 2 | 0.5 - 1 | 0.5 - 1.5 | 2.5 - 3.5 | 2.5 - 3.5 | 2.5 - 3.5 |
| | Sample Date | 8/26/2004 | 8/26/2004 | 8/30/2004 | 8/30/2004 | 8/30/2004 | 8/30/2004 | 8/30/2004 |
| | OU | OU2 | OU2 | OU2 | OU2 | OU2 | OU2 | OU2 |
| Compound (Concentrations in µg/kg) | McDonalds PECs | | | | | | | |
| Naphthalene | 561 | 120 J | 330 U | 330 U | 330 U | 5 | 1.3 J | 0.84 J |
| 2-Methylnaphthalene | 200 | 93 J | 330 U | 330 U | 330 U | 6.6 | 0.58 J | 5 U |
| Acenaphthylene | 200 | 22 J | 330 U | 330 U | 330 U | 0.78 J | 5 U | 5 U |
| Acenaphthene | 300 | 330 U | 330 U | 330 U | 330 U | 0.46 J | 5 U | 5 U |
| Fluorene | 536 | 330 U | 330 U | 330 U | 330 U | 0.57 J | 5 U | 5 U |
| Dibenzofuran | -- | 43 J | 330 U | 330 U | 330 U | 2.3 J | 0.22 J | 5 U |
| Phenanthrene | 1170 | 150 J | 16 J | 14 J | 330 U | 11 | 5 U | 5 U |
| Anthracene | 845 | 46 J | 330 U | 330 U | 330 U | 0.92 J | 5 U | 5 U |
| Fluoranthene | 2230 | 250 J | 36 J | 19 J | 18 J | 9.1 | 0.44 J | 0.39 J |
| Pyrene | 1520 | 200 J | 31 J | 330 U | 17 J | 11 | 0.4 J | 5 U |
| Benzo(b)fluoranthene | -- | 190 J | 22 J | 330 U | 330 U | 5.8 | 0.54 J | 5 U |
| Benzo(k)fluoranthene | 13000 | 150 J | 330 U | 330 U | 330 U | 5.3 | 5 U | 5 U |
| Benzo(a)anthracene | 1050 | 120 J | 19 J | 330 U | 330 U | 5.5 | 0.27 J | 5 U |
| Chrysene | 1290 | 240 J | 25 J | 330 U | 330 U | 8.3 | 5 U | 5 U |
| Benzo(a)pyrene | 1450 | 150 J | 330 U | 330 U | 330 U | 6.6 | 0.26 J | 5 U |
| Indeno(1,2,3-cd)pyrene | 100 | 170 J | 330 U | 330 U | 330 U | 6.2 | 0.28 J | 5 U |
| Dibenz(a,h)anthracene | 1300 | 38 J | 330 U | 330 U | 330 U | 1.1 J | 5 U | 5 U |
| Benzo(g,h,i)perylene | 300 | 190 J | 33 J | 330 U | 330 U | 7.4 | 0.31 J | 5 U |

***Notes:***

1. PAHs = Polynuclear Aromatic Hydrocarbons by EPA Method 8270C (SIM).
2. µg/kg = Micrograms per kilogram.
3. PEC = Probable Effect Concentration, values taken from Portland Harbor Joint Source Control Strategy, Final - Dec. 2005
4. -- = No screening level available or not analyzed.
5. J = The result is an estimated concentration that is less than the method reporting limit (MRL) but greater than or equal to the method detection limit (MDL).
6. U = The compound was analyzed for but was not detected at or above the MRL/MDL.
7. D = Dilution.
8. **Bold** values indicate that the detected concentration exceeds the PEC.
9. Sample ID nomenclature is per the following: type of sample-sample number-depth in feet-designation.
   For example T4S1SB-46-1-1 = soil boring (SB) number 46, collected 1 foot below the ground surface, primary sample (1).
   Soil sample number 6 = T4S1S-6 = surface

Table 1B - PAHs and TPH in Surface Soil Samples
Terminal 4 Slip 3 Remedial Investigation

| | Lab ID | K9909106-001 | K9909106-002 | K9909106-003 | K9909106-004 | K9909106-005 | K9909106-006 | K9909106-007 | K9909106-008 | K9909106-008 |
|---|---|---|---|---|---|---|---|---|---|---|
| | Sample ID | HC-SS-01 | HC-SS-02 | HC-SS-03 | HC-SS-04 | HC-SS-05 | HC-SS-06 | HC-SS-07 | HC-SS-08 | HC-SS-08 (dup) |
| | Drainage Basir | D | D | D | J | K | D | D | D | D |
| | Sampling Date | 12/16/99 | 12/16/99 | 12/16/99 | 12/16/99 | 12/16/99 | 12/16/99 | 12/16/99 | 12/16/99 | 12/16/99 |
| | Depth in Feet | 1-2 | 2-3 | 2-3 | 0-1 | 1-2 | 0-1 | 1-2 | 1-2 | 1-2 |
| PAHs in mg/kg | PECs (McDonalds et al) | | | | | | | | | |
| 2-Methylnaphthalene | 0.2 | 0.02 | 0.005 U | 0.021 | 0.024 | 0.008 | **500** J | **2** | 0.02 | 0.005 U |
| Acenaphthene | 0.3 | 0.005 U | 0.005 U | 0.005 U | 0.25 | 0.005 U | **12** J | 0.12 | 0.005 | 0.028 |
| Acenaphthylene | 0.2 | 0.007 | 0.005 U | 0.005 U | 0.006 | 0.005 U | 0.05 UJ | 0.005 U | 0.005 U | 0.005 U |
| Anthracene | 0.845 | 0.011 | 0.005 U | 0.016 | 0.31 | 0.007 | **4.5** J | 0.04 | 0.015 | 0.035 |
| Fluorene | 0.536 | 0.005 U | 0.005 U | 0.008 | 0.1 | 0.005 U | **19** J | 0.15 | 0.005 U | 0.012 |
| Naphthalene | 0.561 | 0.017 | 0.005 U | 0.008 | 0.033 | 0.008 | **49** J | 0.024 | 0.016 | 0.005 U |
| Phenanthrene | 1.17 | 0.03 | 0.005 U | 0.064 | **1.3** | 0.023 | **29** J | 0.18 | 0.054 | 0.15 |
| Benzo(a)anthracene | 1.05 | 0.099 | 0.005 U | 0.12 | **2.2** | 0.048 | 0.26 J | 0.013 | 0.052 | 0.27 |
| Benzo(a)pyrene | 1.45 | 0.15 | 0.005 U | 0.005 U | **2.9** | 0.07 | 0.05 UJ | 0.023 | 0.067 | 0.38 |
| Benzo(b)fluoranthene | -- | 0.1 | 0.005 U | 0.08 | 2.5 | 0.048 | 0.05 UJ | 0.024 | 0.064 | 0.34 |
| Benzo(k)fluoranthene | 13 | 0.14 | 0.007 | 0.026 | 2.4 | 0.056 | 0.26 J | 0.023 | 0.066 | 0.32 |
| Benzo(g,h,i)perylene | 0.3 | 0.16 | 0.007 | 0.047 | **1.7** | 0.069 | 0.05 UJ | 0.043 | 0.064 | 0.28 |
| Chrysene | 1.29 | 0.14 | 0.006 | 0.33 | **2.3** | 0.057 | 0.43 J | 0.028 | 0.068 | 0.31 |
| Dibenz(a,h)anthracene | 1.3 | 0.018 | 0.005 U | 0.014 | 0.35 | 0.008 | 0.05 UJ | 0.005 | 0.011 | 0.06 |
| Fluoranthene | 2.23 | 0.17 | 0.006 | 0.052 | **2.9** | 0.088 | 1.1 J | 0.04 | 0.11 | 0.4 |
| Indeno(1,2,3-cd)pyrene | 0.1 | **0.16** | 0.007 | 0.021 | **2.7** | 0.073 | 0.05 UJ | 0.041 | 0.066 | **0.35** |
| Pyrene | 1.52 | 0.23 | 0.008 | 0.15 | **2.8** | 0.11 | **1.6** J | 0.061 | 0.1 | 0.35 |
| Dibenzofuran | -- | 0.007 | 0.005 U | 0.005 U | 0.048 | 0.005 U | 4.9 J | 0.005 U | 0.009 | 0.006 |
| **TPH[1] in mg/kg** | | | | | | | | | | |
| Diesel Region | **--** | 25 U | 25 U | 2500 | 25 U | 25 U | 430 | 30000 | 25 U | |
| Oil Region | -- | 50 U | 50 U | 3800 | 110 | 50 U | 120 | 5000 U | 84 | |

***Notes:***

1. J = Estimated value.
2. U = Not detected at the indicated sample quantitaion limit.
3. 1 = Area resampled for PAH analyses
4. **Bold** = Exceeds PEC

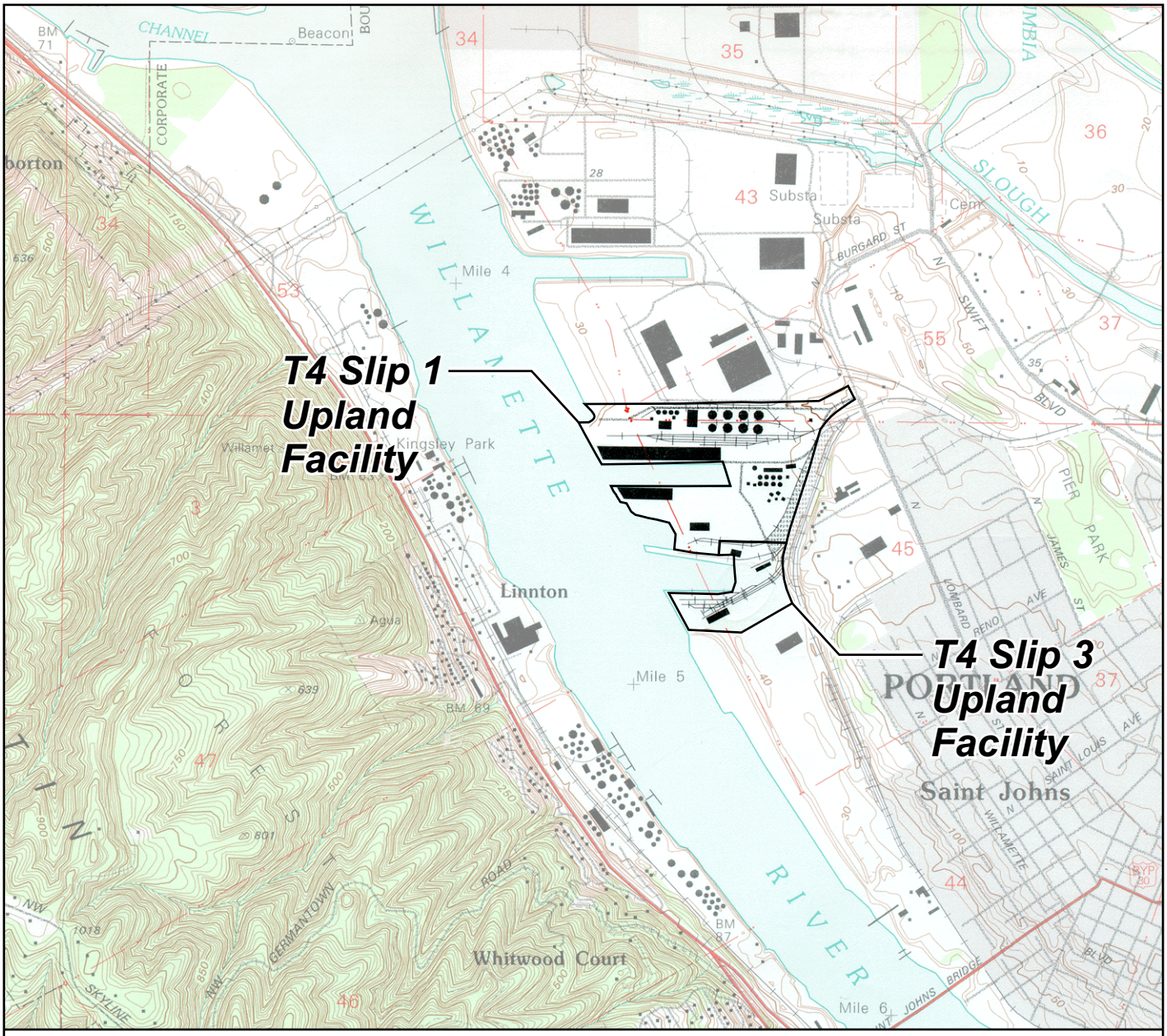
Table 1C - PAH Concentrations in Surface Soil
Quaker State Tank Farm Area

| | Sample ID | Soil #1 | Soil #2 | Soil #2B | Soil #13 | Soil #14 | Soil #15 | Soil #16 | Soil #17 | Soil #18 | Soil #19 | Soil #20 | Soil #21 | Soil #22 | Soil #23 | Soil #24 | Soil #25 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | Depth (ft) | 0.5 - 3.0 | 0.5 - 3.0 | 1.5 - 2.0 | 1.0 - 1.5 | 1.0 - 1.5 | 1.0 - 1.5 | 3.0 - 3.5 | 0.0 - 1.0 | 0.0 - 1.0 | 0.0 - 1.0 | 0.0 - 1.0 | 0.0 - 1.0 | 0.0 - 1.0 | 0.0 - 1.0 | 0.0 - 1.0 | 0.0 - 1.0 |
| | Date | 8-Oct-04 | 11-Oct-04 | 4-Nov-04 | 11-Oct-04 | 11-Oct-04 | 11-Oct-04 | 11-Oct-04 | 5-Nov-04 | 4-Nov-04 | 4-Nov-05 | 4-Nov-04 | 4-Nov-04 | 4-Nov-04 | 4-Nov-04 | 5-Nov-04 | 5-Nov-04 |
| Analyte (Concentrations in µg/kg [ppb]) | McDonalds PECs | | | | | | | | | | | | | | | | |
| Acenaphthene | 300 | 27.9 | 158 | < 67.0 | < 67.0 | 70.3 | < 134 | 16.0 | < 335 | < 335 | < 134 | < 134 | < 134 | < 134 | < 134 | < 268 | < 67.0 |
| Acenaphthylene | 200 | < 13.4 | < 67.0 | < 67.0 | < 67.0 | < 67.0 | < 134 | < 13.4 | < 335 | < 335 | < 134 | < 134 | < 134 | < 134 | < 134 | < 268 | < 67.0 |
| Anthracene | 845 | 25.5 | 124 | < 67.0 | < 67.0 | < 67.0 | < 134 | 16.1 | < 335 | < 335 | < 134 | < 134 | < 134 | < 134 | < 134 | < 268 | < 67.0 |
| Benzo(a)anthracene | 1,050 | 267 | 1,050 | 138 | 74.2 | 532 | 192 | 115 | 624 | 1,250 | 637 | 552 | 648 | 257 | < 134 | 327 | 85.7 |
| Benzo(a)pyrene | 1,450 | 348 | 1,220 | 238 | 107 | 655 | 194 | 144 | 818 | 1,580 | 876 | 665 | 810 | 305 | 170 | 374 | 108 |
| Benzo(b)fluoranthene | -- | 344 | 1,150 | 179 | 85.5 | 638 | 170 | 131 | 760 | 1,710 | 854 | 519 | 830 | 359 | 166 | 417 | 112 |
| Benzo(ghi)perylene | 300 | 318 | 1,060 | 242 | 132 | 603 | 251 | 133 | 844 | 1,260 | 744 | 593 | 793 | 301 | 473 | 348 | 107 |
| Benzo(k)fluoranthene | 13,000 | 245 | 913 | 145 | 67.4 | 461 | 142 | 102 | 628 | 1,130 | 595 | 500 | 581 | 250 | < 134 | 322 | 79.5 |
| Chrysene | 1,290 | 322 | 1,190 | 188 | 96.8 | 616 | 231 | 120 | 695 | 1,430 | 749 | 631 | 763 | 328 | 163 | 382 | 98.4 |
| Dibenzo(a,h)anthracene | 1,300 | 93.3 | 333 | < 67.0 | < 67.0 | 184 | < 134 | 39.8 | < 335 | 369 | 169 | < 134 | 201 | < 134 | < 134 | < 268 | < 67.0 |
| Fluoranthene | 2,230 | 401 | 1,800 | 229 | 124 | 866 | 321 | 158 | 934 | 1,910 | 1,020 | 957 | 1,110 | 415 | 190 | 513 | 126 |
| Fluorene | 536 | 14.5 | 77.8 | < 67.0 | < 67.0 | < 67.0 | < 134 | < 13.4 | < 335 | < 335 | < 134 | < 134 | < 134 | < 134 | < 134 | < 268 | < 67.0 |
| Indeno(1,2,3-cd)pyrene | 100 | 280 | 968 | 174 | 95.2 | 537 | 166 | 116 | 590 | 1,080 | 597 | 456 | 632 | 254 | 169 | 301 | 84.5 |
| Naphthalene | 561 | < 13.4 | < 67.0 | < 67.0 | < 67.0 | < 67.0 | < 134 | < 13.4 | < 335 | < 335 | < 134 | < 134 | < 134 | < 134 | < 134 | < 268 | < 67.0 |
| Phenanthrene | 1,170 | 167 | 776 | < 67.0 | < 67.0 | 352 | 174 | 68.6 | 365 | 761 | 349 | 230 | 484 | 186 | < 134 | < 268 | < 67.0 |
| Pyrene | 1,520 | 432 | 1,400 | 308 | 144 | 766 | 563 | 153 | 878 | 1,630 | 1,080 | 1,070 | 981 | 370 | 446 | 449 | 121 |

***Notes:***

1. **Bold** Represents Detected Concentrations Above PEC.
2. < = Not Detected at Associated Method Reporting Limit.
3. RBC = Oregon DEQ Risk Based Concentration (December 17, 2003) - Direct Contact with Soil.
4. PRG = EPA Region IX Preliminary Remediation Goal (October 1, 2002) - Direct Contact with Soil.
5. NA = Not Available.

** The former Quaker State Tank Farm area, while in Basin J, does not drain to any of the catch basins; surface water in this area infiltrates.




Base map prepared from the USGS 7.5-minute quadrangle of Linnton, Oregon, dated 1990.

0 2000 4000

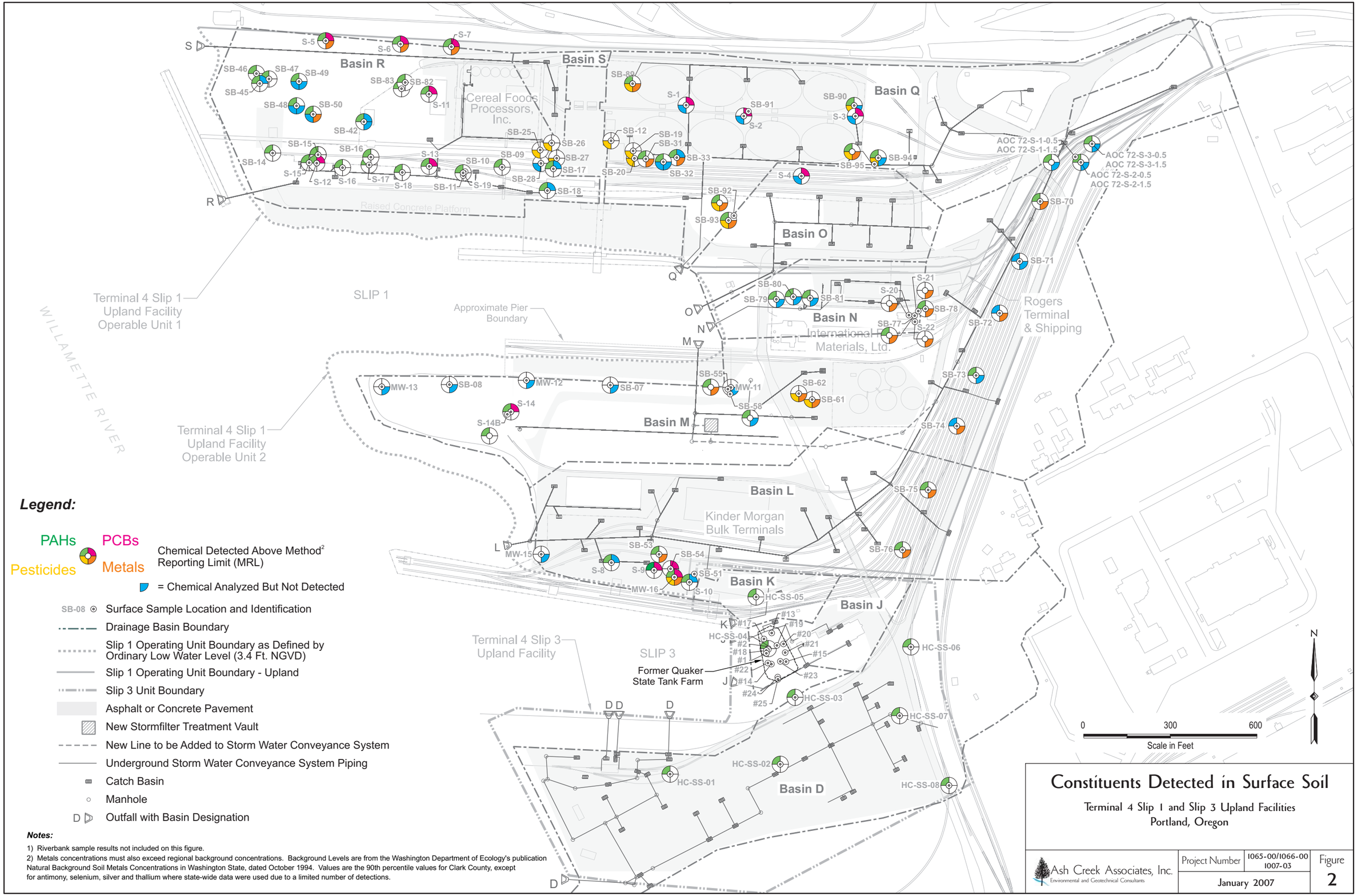
Scale in Feet


N

# Facility Location Map

Terminal 4 Slip 1 and Slip 3 Upland Facilities
Portland, Oregon

| | | | |
|---|---|---|---|
| Ash Creek Associates, Inc. Environmental and Geotechnical Consultants | Project Number | 1065-00/1066-00 1007-03 | Figure 1 |
| | February 2007 | | |




***Legend:***

PAHs PCBs Pesticides Metals — Chemical Detected Above Method[2] Reporting Limit (MRL)

= Chemical Analyzed But Not Detected

- SB-08 — Surface Sample Location and Identification
- Drainage Basin Boundary
- Slip 1 Operating Unit Boundary as Defined by Ordinary Low Water Level (3.4 Ft. NGVD)
- Slip 1 Operating Unit Boundary - Upland
- Slip 3 Unit Boundary
- Asphalt or Concrete Pavement
- New Stormfilter Treatment Vault
- New Line to be Added to Storm Water Conveyance System
- Underground Storm Water Conveyance System Piping
- Catch Basin
- Manhole
- D — Outfall with Basin Designation

***Notes:***

1) Riverbank sample results not included on this figure.
2) Metals concentrations must also exceed regional background concentrations. Background Levels are from the Washington Department of Ecology's publication Natural Background Soil Metals Concentrations in Washington State, dated October 1994. Values are the 90th percentile values for Clark County, except for antimony, selenium, silver and thallium where state-wide data were used due to a limited number of detections.

# Constituents Detected in Surface Soil

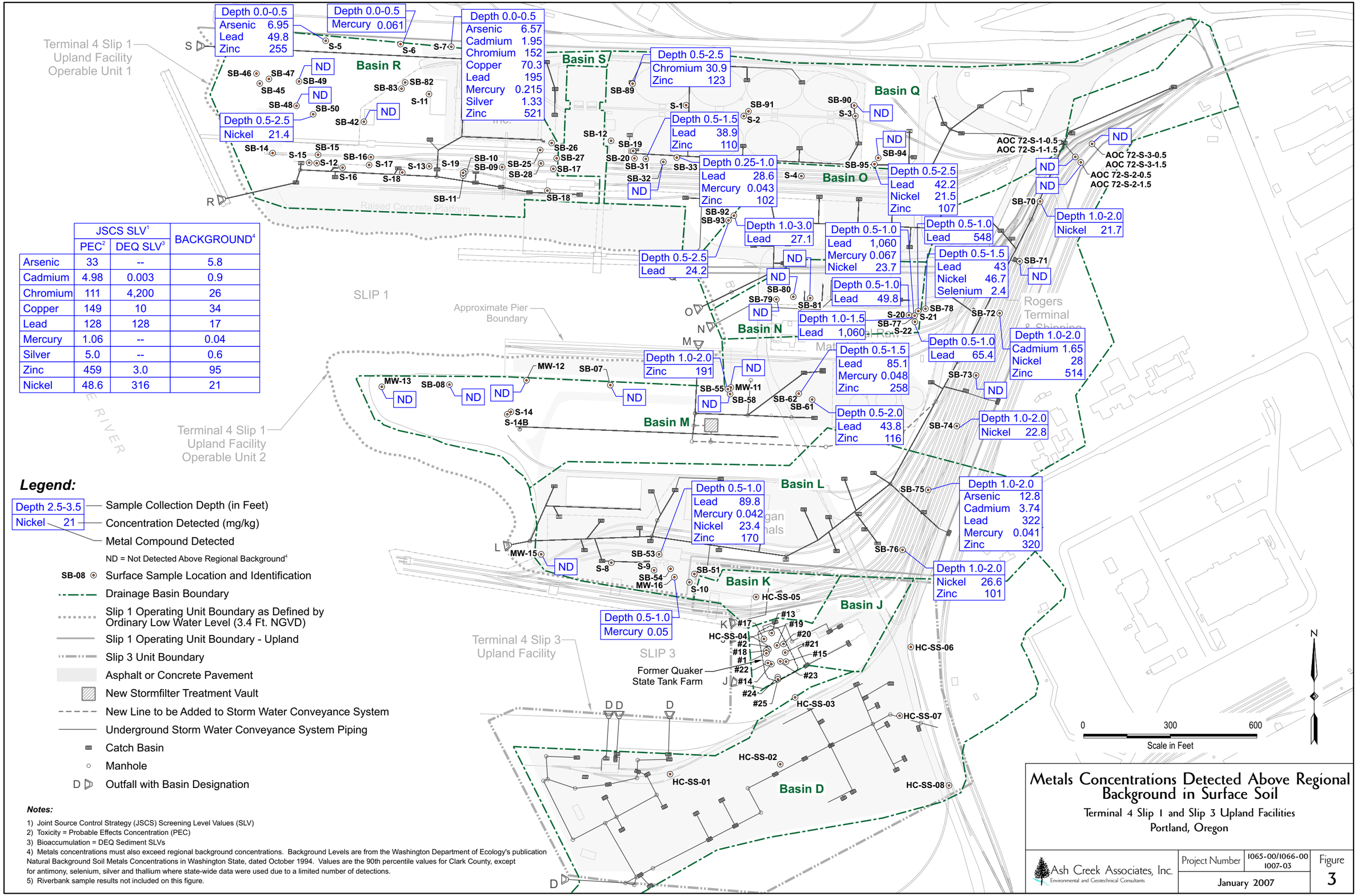
Terminal 4 Slip 1 and Slip 3 Upland Facilities
Portland, Oregon

Ash Creek Associates, Inc.
Environmental and Geotechnical Consultants

Project Number 1065-00/1066-00 1007-03

January 2007

Figure 2




| | JSCS SLV[1] | | BACKGROUND[4] |
|---|---|---|---|
| | PEC[2] | DEQ SLV[3] | |
| Arsenic | 33 | -- | 5.8 |
| Cadmium | 4.98 | 0.003 | 0.9 |
| Chromium | 111 | 4,200 | 26 |
| Copper | 149 | 10 | 34 |
| Lead | 128 | 128 | 17 |
| Mercury | 1.06 | -- | 0.04 |
| Silver | 5.0 | -- | 0.6 |
| Zinc | 459 | 3.0 | 95 |
| Nickel | 48.6 | 316 | 21 |

## *Legend:*

- Depth 2.5-3.5 / Nickel 21 — Sample Collection Depth (in Feet) / Concentration Detected (mg/kg) / Metal Compound Detected
- ND = Not Detected Above Regional Background[4]
- SB-08 — Surface Sample Location and Identification
- Drainage Basin Boundary
- Slip 1 Operating Unit Boundary as Defined by Ordinary Low Water Level (3.4 Ft. NGVD)
- Slip 1 Operating Unit Boundary - Upland
- Slip 3 Unit Boundary
- Asphalt or Concrete Pavement
- New Stormfilter Treatment Vault
- New Line to be Added to Storm Water Conveyance System
- Underground Storm Water Conveyance System Piping
- Catch Basin
- Manhole
- D — Outfall with Basin Designation

***Notes:***

1) Joint Source Control Strategy (JSCS) Screening Level Values (SLV)
2) Toxicity = Probable Effects Concentration (PEC)
3) Bioaccumulation = DEQ Sediment SLVs
4) Metals concentrations must also exceed regional background concentrations. Background Levels are from the Washington Department of Ecology's publication Natural Background Soil Metals Concentrations in Washington State, dated October 1994. Values are the 90th percentile values for Clark County, except for antimony, selenium, silver and thallium where state-wide data were used due to a limited number of detections.
5) Riverbank sample results not included on this figure.

# Metals Concentrations Detected Above Regional Background in Surface Soil

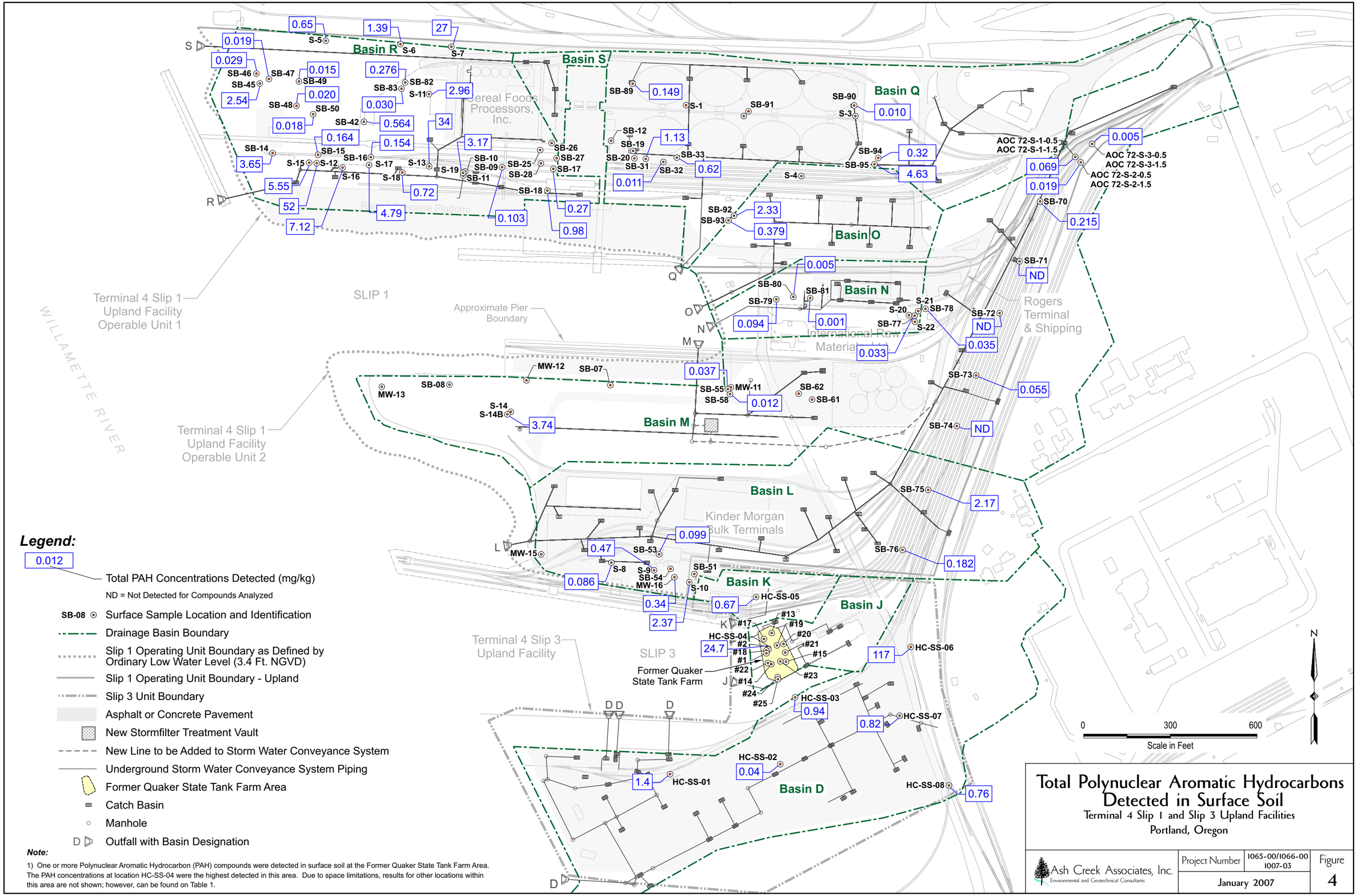
Terminal 4 Slip 1 and Slip 3 Upland Facilities
Portland, Oregon

Ash Creek Associates, Inc.
Environmental and Geotechnical Consultants

Project Number 1065-00/1066-00 1007-03

January 2007

Figure 3




## Legend:

- 0.012 — Total PAH Concentrations Detected (mg/kg)
  - ND = Not Detected for Compounds Analyzed
- SB-08 — Surface Sample Location and Identification
- Drainage Basin Boundary
- Slip 1 Operating Unit Boundary as Defined by Ordinary Low Water Level (3.4 Ft. NGVD)
- Slip 1 Operating Unit Boundary - Upland
- Slip 3 Unit Boundary
- Asphalt or Concrete Pavement
- New Stormfilter Treatment Vault
- New Line to be Added to Storm Water Conveyance System
- Underground Storm Water Conveyance System Piping
- Former Quaker State Tank Farm Area
- Catch Basin
- Manhole
- D — Outfall with Basin Designation

***Note:***

1) One or more Polynuclear Aromatic Hydrocarbon (PAH) compounds were detected in surface soil at the Former Quaker State Tank Farm Area. The PAH concentrations at location HC-SS-04 were the highest detected in this area. Due to space limitations, results for other locations within this area are not shown; however, can be found on Table 1.

# Total Polynuclear Aromatic Hydrocarbons Detected in Surface Soil

Terminal 4 Slip 1 and Slip 3 Upland Facilities
Portland, Oregon

| Ash Creek Associates, Inc. Environmental and Geotechnical Consultants | Project Number | 1065-00/1066-00 1007-03 | Figure 4 |
|---|---|---|---|
| | January 2007 | | |

| | JSCS SLV[1] | |
|---|---|---|
| | PEC[2] | DEQ SLV[3] |
| Aroclor 1254 | 0.3 | 0.01 |
| Aroclor 1260 | 0.2 | -- |

Depth 0.0-0.5
Aroclor 1254 0.096
Aroclor 1260 0.15

Depth 0.0-0.5
Aroclor 1254 0.062
Aroclor 1260 0.089

Depth 0.0-0.5
Aroclor 1254 0.10
Aroclor 1260 0.17

Depth 0.0-0.5
Aroclor 1254 0.055
Aroclor 1260 0.033

Depth 0.0-0.5
Aroclor 1254 0.11
Aroclor 1260 0.13

Depth 0.0-0.5
Aroclor 1254 0.08
Aroclor 1260 0.17

Depth 0.0-0.5
Aroclor 1254 0.38
Aroclor 1260 0.25

Depth 0.0-0.5
Aroclor 1254 0.56
Aroclor 1260 0.53

Depth 0.0-0.5
Aroclor 1254 0.69
Aroclor 1260 0.42

Depth 0.0-0.5
Aroclor 1254 0.014

Depth 1.0-2.0
Aroclor 1254 0.11
Aroclor 1260 0.12

Depth 0.0-0.5
Aroclor 1260 0.023

Depth 0.5-1.0
Aroclor 1260 0.045

Depth 0.5-1.0
Aroclor 1260 0.022

ND

Basin S
Basin R
Basin Q
Basin O
Basin N
Basin M
Basin L
Basin K
Basin J
Basin D

Cereal Foods
Rogers Terminal & Shipping
International Raw Materials, Ltd.
Kinder Morgan
Former Quaker State Tank Farm
Terminal 4 Slip 1 Upland Facility Operable Unit 1
Terminal 4 Slip 1 Upland Facility Operable Unit 2
Terminal 4 Slip 3 Upland Facility
SLIP 1
SLIP 3
Approximate Pier Boundary
WILLAMETTE RIVER

AOC 72-S-1-0.5
AOC 72-S-1-1.5
AOC 72-S-3-0.5
AOC 72-S-3-1.5
AOC 72-S-2-0.5
AOC 72-S-2-1.5

0 300 600
Scale in Feet

N

## Legend:

- Depth 0.5-1.0 / Aroclor 1260 0.022 — Sample Collection Depth (in Feet); Concentration Detected (mg/kg)
- Compound Detected
- ND = Not Detected for Compounds Analyzed
- SB-08 — Surface Sample Location and Identification
- Drainage Basin Boundary
- Slip 1 Operating Unit Boundary as Defined by Ordinary Low Water Level (3.4 Ft. NGVD)
- Slip 1 Operating Unit Boundary - Upland
- Slip 3 Unit Boundary
- Asphalt or Concrete Pavement
- New Stormfilter Treatment Vault
- New Line to be Added to Storm Water Conveyance System
- Underground Storm Water Conveyance System Piping
- Catch Basin
- Manhole
- Outfall with Basin Designation

***Notes:***

1) Joint Source Control Strategy (JSCS) Screening Level Values (SLV)
2) Toxicity = Probable Effects Concentration (PEC)
3) Bioaccumulation = DEQ Sediment SLVs

# Polychlorinated Biphenyl Concentrations Detected in Surface Soil

Terminal 4 Slip 1 and Slip 3 Upland Facilities
Portland, Oregon

Ash Creek Associates, Inc.
Environmental and Geotechnical Consultants

Project Number 1065-00/1066-00 1007-03

January 2007

Figure 5

| | JSCS SLV[1] | |
|---|---|---|
| | PEC[2] | DEQ SLV[3] |
| gamma-Chlordane | 17.6 | -- |
| alpha-Chlordane | 17.6 | -- |
| Dieldrin | 61 | -- |
| 4,4'-DDE | 31.3 | 0.3 |
| 4,4'-DDD | 28 | 0.3 |
| Endrin Aldehyde | -- | -- |
| 4,4'-DDT | 62.9 | 0.3 |
| Endrin Ketone | -- | -- |

**SB-12**
Depth 1.0-2.0
4,4'-DDT 8.2

**SB-27**
Depth 1.0-2.0
4,4'-DDE 0.9
Endrin Aldehyde 1.4
4,4'-DDT 3.9
Endrin Ketone 1.9

**SB-89**
Depth 0.5-2.5
gamma-Chlordane 0.418
alpha-Chlordane 0.334
Dieldrin 0.353
4,4'-DDE 1.29
4,4'-DDD 0.381
4,4'-DDT 5.21

**SB-90**
Depth 1.0-3.0
4,4'-DDT 0.176

**SB-19**
Depth 0.5-1.5
Dieldrin 0.43
4,4'-DDE 8.6

**SB-25**
Depth 0.5-1.5
gamma-Chlordane 4.8
alpha-Chlordane 3.4
4,4'-DDE 5.0
Endrin 2.2
4,4'-DDT 8.2

**SB-20**
Depth 0.5-1.0
4,4'-DDT 5.3

**SB-26**
Depth 1.0-2.0
gamma-Chlordane 0.76
alpha-Chlordane 1.1
4,4'-DDE 1.5
Endrin 1.7
4,4'-DDT 7.8
Methoxychlor 4.5

**SB-62**
Depth 0.5-1.5
4,4'-DDE 0.75
4,4'-DDT 5.1

**SB-61**
Depth 0.5-2.0
4,4'-DDT 2.6

**SB-94**
Depth 1.0-3.0
Dieldrin 0.677
Endrin Aldehyde 0.436
4,4'-DDT 2.75

**SB-95**
Depth 0.5-2.5
Dieldrin 1.15
4,4'-DDE 2.55
4,4'-DDT 8.87

**SB-92**
Depth 1.0-3.0
gamma-Chlordane 0.922
alpha-Chlordane 0.974
Dieldrin 0.590
4,4'-DDE 0.888
4,4'-DDD 0.660
4,4'-DDT 3.33

**SB-93**
Depth 0.5-2.5
Dieldrin 1.10
4,4'-DDE 1.02
4,4'-DDT 2.29

**MW-16**
Depth 0.5-1.0
Heptachlor 0.35
gamma-Chlordane 0.084
4,4'-DDE 0.092
4,4'-DDD 0.28
4,4'-DDT 2.1
Methoxychlor 0.99

Basin R
Basin S
Basin Q
Basin O
Basin N
Basin M
Basin L
Basin K
Basin J
Basin D

Terminal 4 Slip 1
Upland Facility
Operable Unit 1

Terminal 4 Slip 1
Upland Facility
Operable Unit 2

Terminal 4 Slip 3
Upland Facility

WILLAMETTE RIVER

Approximate P
Bounda

International Raw
Materials, Ltd.

Rogers
Terminal
& Shipping

Kinder Morgan
Bulk Terminals

Former
Quaker
State Tank
Farm

AOC 72-S-1-0.5
AOC 72-S-1-1.5
AOC 72-S-3-0.5
AOC 72-S-3-1.5
AOC 72-S-2-0.5
AOC 72-S-2-1.5

0 300 600
Scale in Feet

N

## *Legend:*

SB-20
Depth 0.5-1.0
4,4'-DDT 5.3

- Location Identification
- Sample Collection Depth (in Feet)
- Concentration Detected (µg/kg)
- Detected Compound
- ND = Not Detected for Compounds Analyzed
- SB-08 — Surface Sample Location and Identification
- Drainage Basin Boundary
- Slip 1 Operating Unit Boundary as Defined by Ordinary Low Water Level (3.4 Ft. NGVD)
- Slip 1 Operating Unit Boundary - Upland
- Slip 3 Unit Boundary
- Asphalt or Concrete Pavement
- New Stormfilter Treatment Vault
- New Line to be Added to Storm Water Conveyance System
- Underground Storm Water Conveyance System Piping
- Catch Basin
- Manhole
- D — Outfall with Basin Designation

***Notes:***

1) Joint Source Control Strategy (JSCS) Screening Level Values (SLV)
2) Toxicity = Probable Effects Concentration (PEC)
3) Bioaccumulation = DEQ Sediment SLVs

# Pesticide Concentrations Detected in Surface Soil

Terminal 4 Slip 1 and Slip 3 Upland Facilities
Portland, Oregon

Ash Creek Associates, Inc.
Environmental and Geotechnical Consultants

Project Number 1065-00/1066-00 1007-03

January 2007

Figure 6

| | JSCS SLV[1] | |
|---|---|---|
| | PEC[2] | DEQ SLV[3] |
| DBP | 100 | -- |
| BEHP | 800 | 330 |
| Phenol | -- | -- |

Depth 0.0-0.5
DBP 19
BEHP 60

Depth 0.0-0.5
Phenol 24
DBP 65
BEHP 400

Depth 0.0-0.5
Phenol 50
DBP 71
BEHP 720

Depth 0.0-0.5
Phenol 50
DBP 71
BEHP 720

Depth 1.0-2.0
BEHP 47

Basin R
Basin S
Basin Q
Basin O
Basin N
Basin M
Basin L
Basin K
Basin J
Basin D

SB-46 SB-47 SB-49 SB-45 SB-48 SB-50 SB-42 SB-83 SB-82 S-11 SB-89 S-1 SB-91 S-2 SB-90 S-3 SB-12 SB-19 SB-31 SB-33 SB-20 SB-32 SB-95 SB-94 S-4 SB-14 S-15 SB-15 S-12 S-16 SB-16 S-17 S-18 S-13 S-19 SB-10 SB-09 SB-25 SB-28 SB-26 SB-27 SB-17 SB-18 SB-11 SB-93 SB-92 SB-80 SB-81 SB-79 S-21 S-20 SB-78 SB-77 S-22 SB-72 SB-73 SB-74 SB-75 SB-76 SB-70 SB-71 MW-12 SB-07 SB-08 MW-13 SB-55 MW-11 SB-62 SB-61 SB-58 S-14 S-14B MW-15 S-8 S-9 SB-53 SB-51 SB-54 MW-16 S-10 HC-SS-05 HC-SS-04 HC-SS-06 HC-SS-03 HC-SS-07 HC-SS-02 HC-SS-01 HC-SS-08 #13 #19 #20 #21 #15 #23 #17 #2 #18 #1 #22 #14 #24 #25

ND

AOC 72-S-1-0.5
AOC 72-S-1-1.5
AOC 72-S-3-0.5
AOC 72-S-3-1.5
AOC 72-S-2-0.5
AOC 72-S-2-1.5

Terminal 4 Slip 1
Upland Facility
Operable Unit 1

Terminal 4 Slip 1
Upland Facility
Operable Unit 2

Terminal 4 Slip 3
Upland Facility

SLIP 1
SLIP 3

Raised Concrete Platform
Approximate Pier Boundary
Former Quaker State Tank Farm
Rogers Terminal & Shipping
International Materials, Ltd.
Kinder Morgan Bulk Terminals
WILLAMETTE RIVER

S R Q O N M L K J D

***Legend:***

Depth 1.0-2.0 — Sample Collection Depth (in Feet)
BEHP 47 — Concentration Detected (µg/kg)
Detected Compound

DBP = Di-n-butyl Phthalate, BEHP = Bis(2-ethylhexyl)Phthalate
ND = Not Detected for Compounds Analyzed

SB-08 — Surface Sample Location and Identification
Drainage Basin Boundary
Slip 1 Operating Unit Boundary as Defined by Ordinary Low Water Level (3.4 Ft. NGVD)
Slip 1 Operating Unit Boundary - Upland
Slip 3 Unit Boundary
Asphalt or Concrete Pavement
New Stormfilter Treatment Vault
New Line to be Added to Storm Water Conveyance System
Underground Storm Water Conveyance System Piping
Catch Basin
Manhole
D — Outfall with Basin Designation

***Notes:***

1) Joint Source Control Strategy (JSCS) Screening Level Values (SLV)
2) Toxicity = Probable Effects Concentration (PEC)
3) Bioaccumulation = DEQ Sediment SLVs

N

0 300 600
Scale in Feet

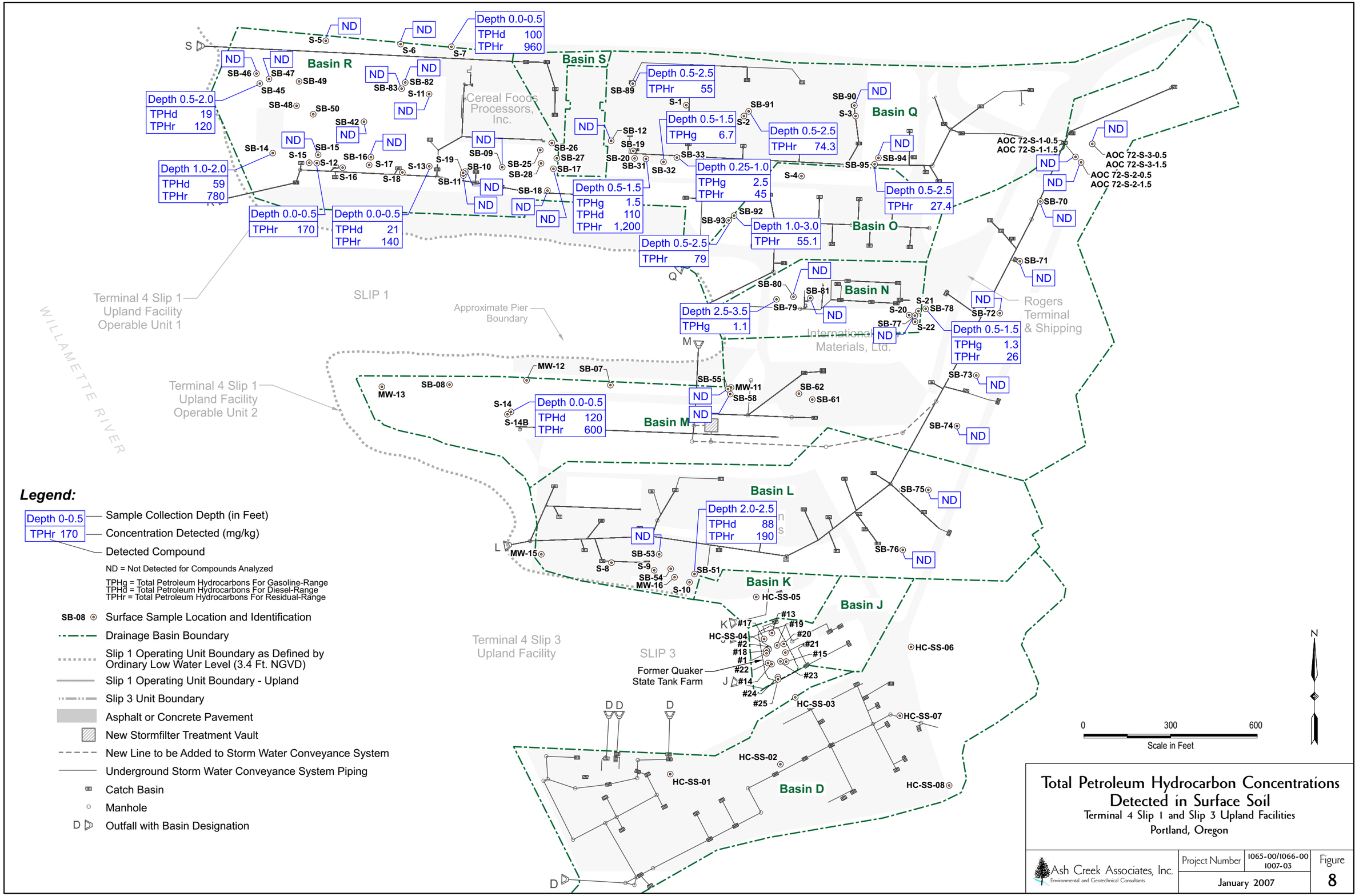
# Semi-Volatile Organic Compounds Detected in Surface Soil
## (Except Polynuclear Aromatic Hydrocarbons)
Terminal 4 Slip 1 and Slip 3 Upland Facilities
Portland, Oregon

Ash Creek Associates, Inc.
Environmental and Geotechnical Consultants

Project Number 1065-00/1066-00 1007-03

January 2007

Figure 7




## Legend:

- Depth 0-0.5 / TPHr 170 — Sample Collection Depth (in Feet) / Concentration Detected (mg/kg) / Detected Compound
- ND = Not Detected for Compounds Analyzed
- TPHg = Total Petroleum Hydrocarbons For Gasoline-Range
  TPHd = Total Petroleum Hydrocarbons For Diesel-Range
  TPHr = Total Petroleum Hydrocarbons For Residual-Range
- SB-08 — Surface Sample Location and Identification
- Drainage Basin Boundary
- Slip 1 Operating Unit Boundary as Defined by Ordinary Low Water Level (3.4 Ft. NGVD)
- Slip 1 Operating Unit Boundary - Upland
- Slip 3 Unit Boundary
- Asphalt or Concrete Pavement
- New Stormfilter Treatment Vault
- New Line to be Added to Storm Water Conveyance System
- Underground Storm Water Conveyance System Piping
- Catch Basin
- Manhole
- D — Outfall with Basin Designation

# Total Petroleum Hydrocarbon Concentrations Detected in Surface Soil

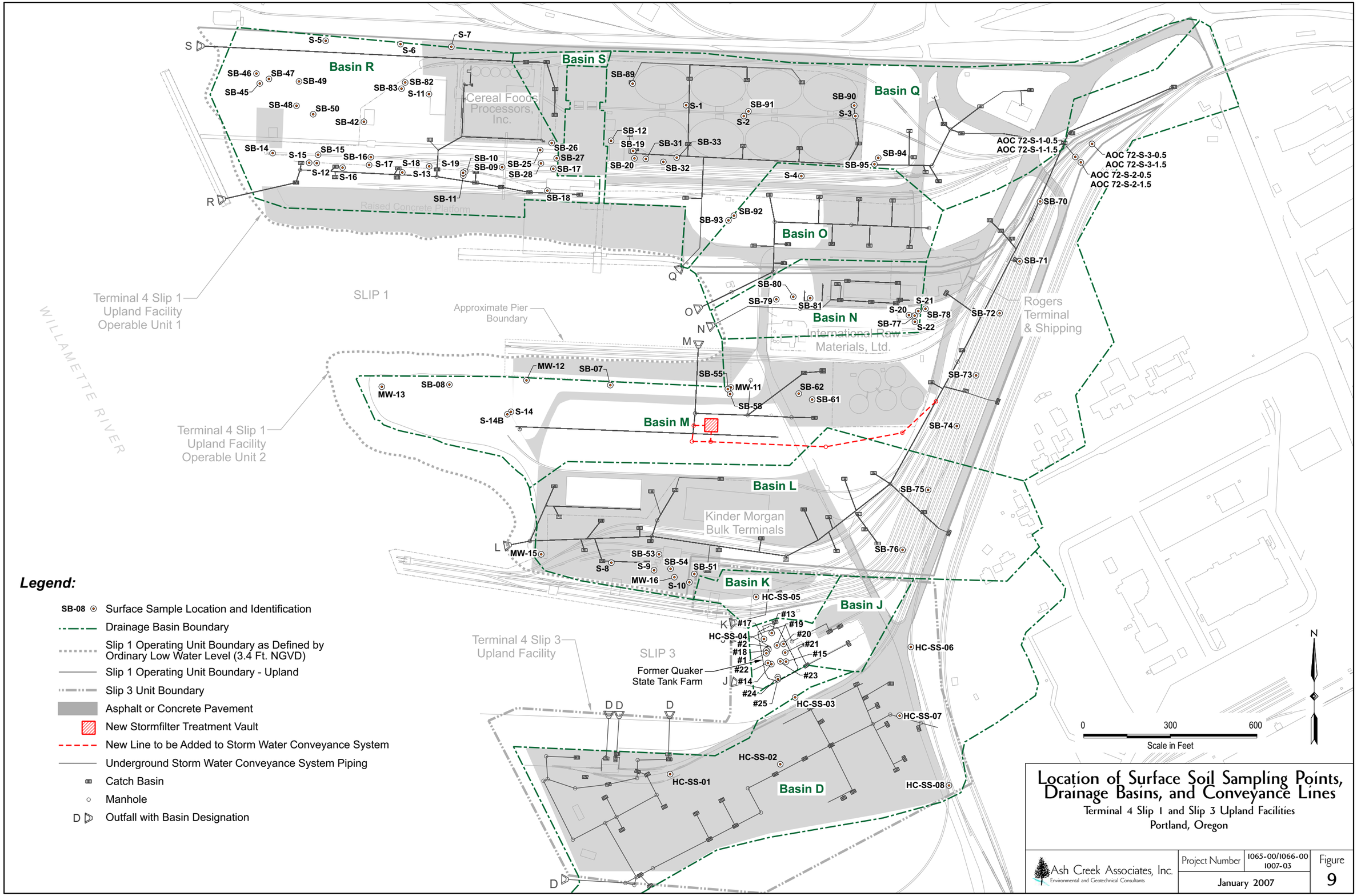
Terminal 4 Slip 1 and Slip 3 Upland Facilities
Portland, Oregon

Ash Creek Associates, Inc.
Environmental and Geotechnical Consultants

Project Number 1065-00/1066-00 1007-03

January 2007

Figure 8




## Legend:

- SB-08 — Surface Sample Location and Identification
- Drainage Basin Boundary
- Slip 1 Operating Unit Boundary as Defined by Ordinary Low Water Level (3.4 Ft. NGVD)
- Slip 1 Operating Unit Boundary - Upland
- Slip 3 Unit Boundary
- Asphalt or Concrete Pavement
- New Stormfilter Treatment Vault
- New Line to be Added to Storm Water Conveyance System
- Underground Storm Water Conveyance System Piping
- Catch Basin
- Manhole
- D — Outfall with Basin Designation

# Location of Surface Soil Sampling Points, Drainage Basins, and Conveyance Lines

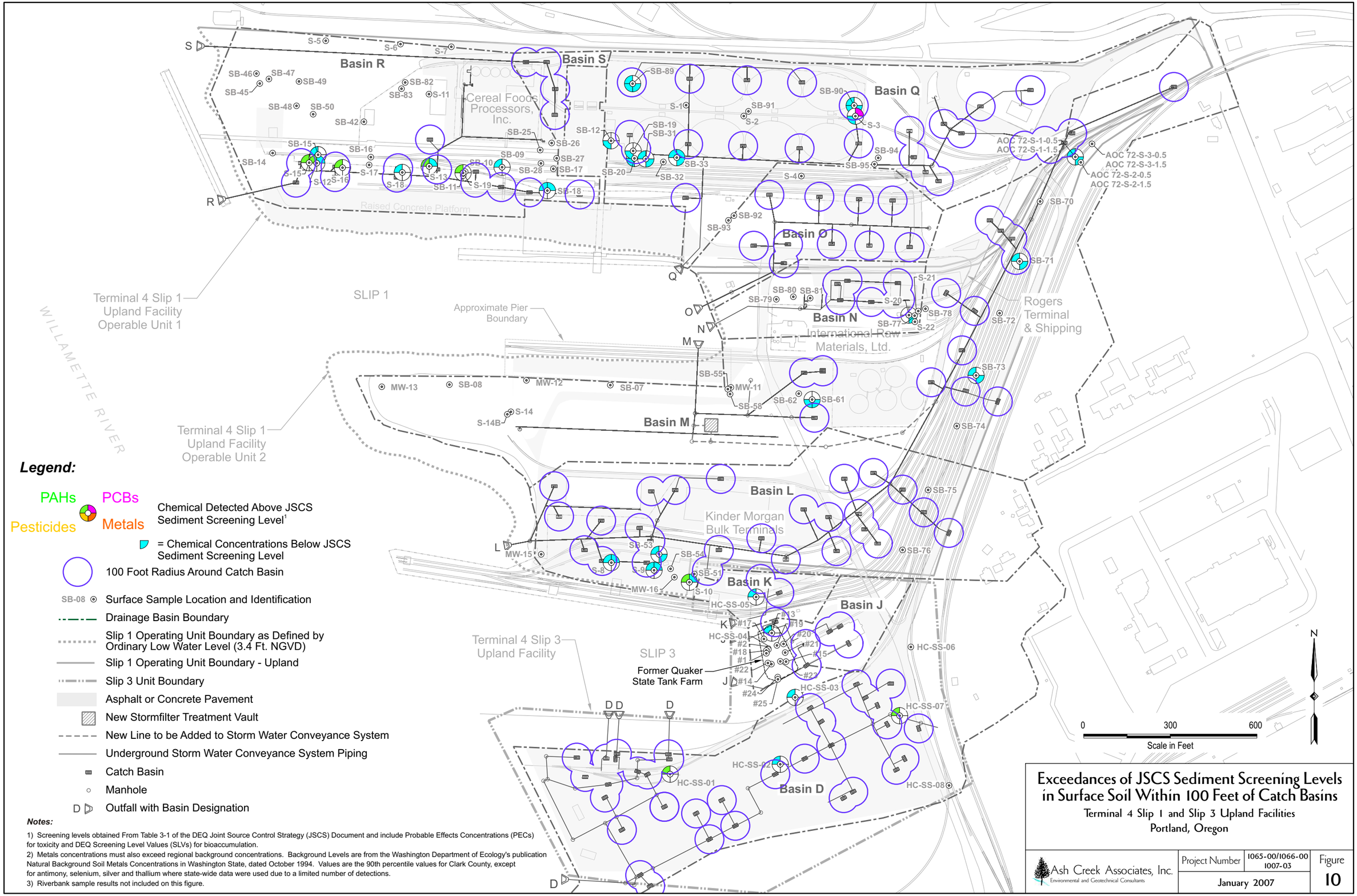
Terminal 4 Slip 1 and Slip 3 Upland Facilities
Portland, Oregon

Ash Creek Associates, Inc.
Environmental and Geotechnical Consultants

Project Number 1065-00/1066-00 1007-03

January 2007

Figure 9




***Legend:***

PAHs PCBs Pesticides Metals — Chemical Detected Above JSCS Sediment Screening Level[1]

= Chemical Concentrations Below JSCS Sediment Screening Level

100 Foot Radius Around Catch Basin

SB-08 — Surface Sample Location and Identification

Drainage Basin Boundary

Slip 1 Operating Unit Boundary as Defined by Ordinary Low Water Level (3.4 Ft. NGVD)

Slip 1 Operating Unit Boundary - Upland

Slip 3 Unit Boundary

Asphalt or Concrete Pavement

New Stormfilter Treatment Vault

New Line to be Added to Storm Water Conveyance System

Underground Storm Water Conveyance System Piping

Catch Basin

Manhole

D — Outfall with Basin Designation

***Notes:***

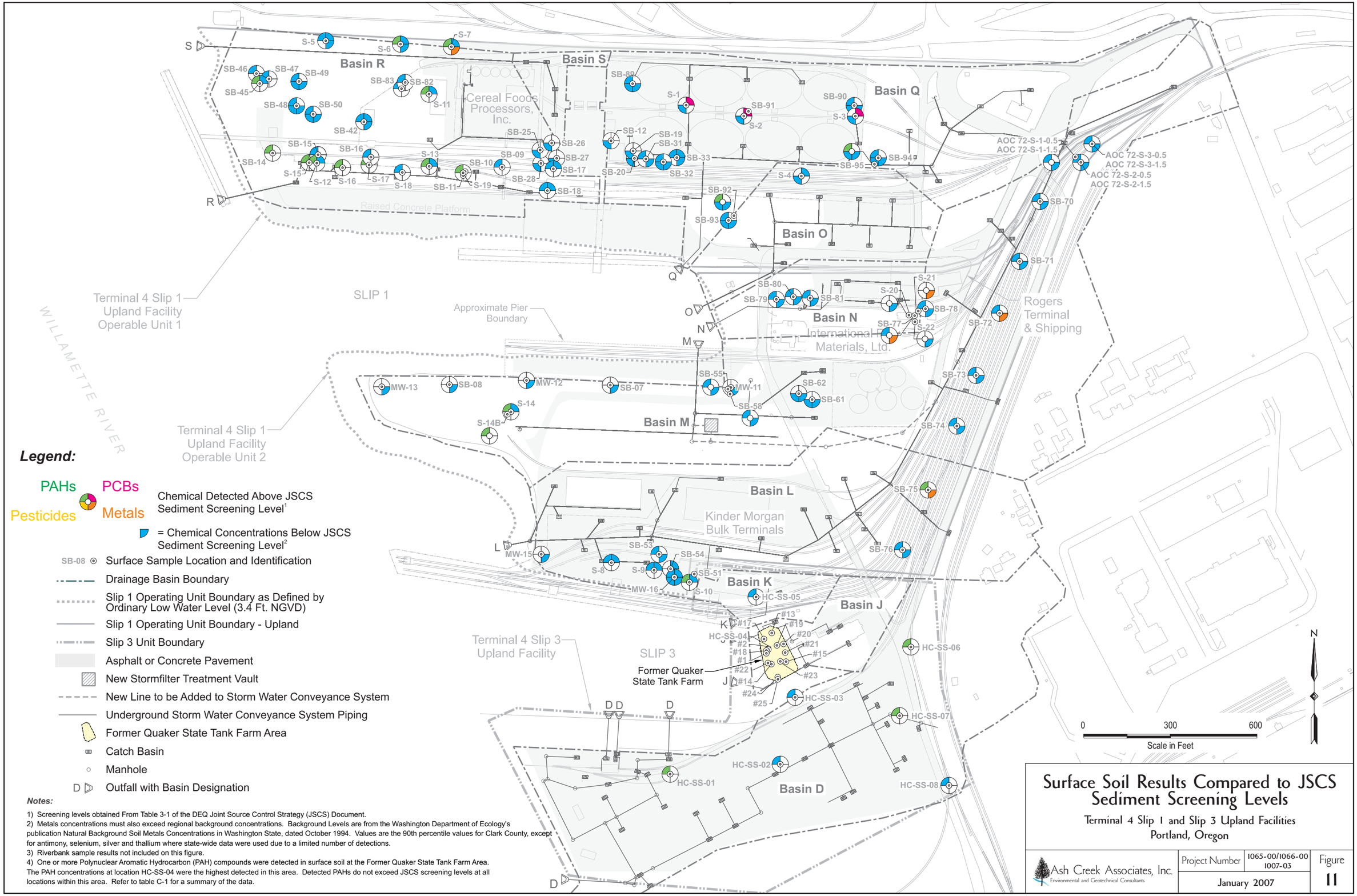
1) Screening levels obtained From Table 3-1 of the DEQ Joint Source Control Strategy (JSCS) Document and include Probable Effects Concentrations (PECs) for toxicity and DEQ Screening Level Values (SLVs) for bioaccumulation.
2) Metals concentrations must also exceed regional background concentrations. Background Levels are from the Washington Department of Ecology's publication Natural Background Soil Metals Concentrations in Washington State, dated October 1994. Values are the 90th percentile values for Clark County, except for antimony, selenium, silver and thallium where state-wide data were used due to a limited number of detections.
3) Riverbank sample results not included on this figure.

# Exceedances of JSCS Sediment Screening Levels in Surface Soil Within 100 Feet of Catch Basins

Terminal 4 Slip 1 and Slip 3 Upland Facilities
Portland, Oregon

Ash Creek Associates, Inc.
Environmental and Geotechnical Consultants

| Project Number | 1065-00/1066-00 1007-03 | Figure |
|---|---|---|
| January 2007 | | 10 |




***Legend:***

PAHs PCBs Pesticides Metals — Chemical Detected Above JSCS Sediment Screening Level[1]

= Chemical Concentrations Below JSCS Sediment Screening Level[2]

SB-08 — Surface Sample Location and Identification

Drainage Basin Boundary

Slip 1 Operating Unit Boundary as Defined by Ordinary Low Water Level (3.4 Ft. NGVD)

Slip 1 Operating Unit Boundary - Upland

Slip 3 Unit Boundary

Asphalt or Concrete Pavement

New Stormfilter Treatment Vault

New Line to be Added to Storm Water Conveyance System

Underground Storm Water Conveyance System Piping

Former Quaker State Tank Farm Area

Catch Basin

Manhole

D — Outfall with Basin Designation

***Notes:***

1) Screening levels obtained From Table 3-1 of the DEQ Joint Source Control Strategy (JSCS) Document.
2) Metals concentrations must also exceed regional background concentrations. Background Levels are from the Washington Department of Ecology's publication Natural Background Soil Metals Concentrations in Washington State, dated October 1994. Values are the 90th percentile values for Clark County, except for antimony, selenium, silver and thallium where state-wide data were used due to a limited number of detections.
3) Riverbank sample results not included on this figure.
4) One or more Polynuclear Aromatic Hydrocarbon (PAH) compounds were detected in surface soil at the Former Quaker State Tank Farm Area. The PAH concentrations at location HC-SS-04 were the highest detected in this area. Detected PAHs do not exceed JSCS screening levels at all locations within this area. Refer to table C-1 for a summary of the data.

# Surface Soil Results Compared to JSCS Sediment Screening Levels

Terminal 4 Slip 1 and Slip 3 Upland Facilities
Portland, Oregon

Ash Creek Associates, Inc.
Environmental and Geotechnical Consultants

Project Number 1065-00/1066-00 1007-03

January 2007

Figure 11